Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

During 1910 *we printed and circulated* 526,500 *copies of* THE ENGINEERING AND MINING JOURNAL.

Our circulation for October, 1911, *averaged* 9875 *copies per issue.*

November 4	10,500
November 11	9,300
November 18	9,300
November 25	9,100

None sent free regularly, no back numbers. Figures are live, net circulation.

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The Engineering and Mining Journal

Vol. 92. NOVEMBER 25, 1911. No. 22.

Geology and Mining

A close relation exists between actual mining operations and the practical application of geology, that is often overlooked by the man in direct charge of a mine. Being a broad subject embodying many theories, concerning which but few men hold exactly the same view, geology is often dismissed by superinendents, including those with and without technical training, as not being applicable to the case in point. It should be remembered that, aside from fundamental facts, geology as taught affords simply the skeleton on which the geology in any particular field is to be built.

The essential point for the operator to observe is, that the time for building up his knowledge of the geology of his mine is while mining is going on. It is certain that at some future time the original orebody will have ceased to exist, and the quesion of finding a new one will arise. Numerous examples of this have occurred in recent years, particular cases being certain mines in Butte and in the Michigan iron country. At present, in the largest and best conducted mines in these districts, the practical application of geology to the discovery of new orebodies has reached a high degree of efficiency, and results have proved the wisdom of the policy.

In one Michigan iron mine an orebody mined for many years had reached that stage where the end was distant only a few months. An organized campaign was conducted by the engineering department, the sole object being to find a new deposit. In the search all geological data available, as to adjoining mines and the district in general, were consulted and carefully mapped and studied. Orders were finally given to drive through barren rock many hundred feet and to raise at the end. At the point computed, this raise entered an orebody, previously unknown. This, perhaps, is an extreme case, but the finding of new deposits through careful sifting of geological data has not been infrequent of late years.

The evidence afforded by rock formations on surface is seldom as satisfactory or conclusive as that secured underground, and the time to obtain the latter is when the evidence is fresh. Once the engineers form the habit of recording all dips, strikes, rock changes, etc., in their proper position, the rapidity with which the geology of a mine or district will, to a large extent, work itself out, is surprising. With these data it is often possible for the local superintendent or engineer to draw the correct conclusions. If extreme complexity makes this impossible, an expert geologist can form his conclusions in half the time ordinarily required.

As Others See Us

"Die Erzlagerstätten der Vereinigten Staaten von Nord Amerika, mit Einschluss von Alaska, Cuba, Portorico und den Philippinen." By Charles L. Henning, Sc.D., Stuttgart, Ferdinand Enke, 1911. ("The Ore Deposits of the United States of North America, including Alaska, Cuba, Porto Rico and the Philippines.")

The author received his training in geology in Germany, his native land, and, as we learn from his preface, is justly proud of having been educated where German industry, German thoroughness and German science surpass everything else in the world. He has passed fifteen years in America and has prepared this review of the metalliferous resources of this country, in order to set before the good people of the Fatherland a concise account of them. Although quite disgusted with the people and conditions in America, as quotations will shortly prove, he has formed, we are happy to observe, a very favorable impression of George Otis Smith, director and "father," and H. C. Rizer, chief clerk and "mother" of the U. S. Geological Survey, and esteems also their predecessors and colleagues, both within and without the organization.

The book is divided into a relatively brief general part, and much longer spe-

cial part. The general part is an introduction which is intended to acquaint those outside this country with the history of American mining, with its official geological survey, its mining laws and customs, and with the prevailing views on metamorphism, insofar as they bear upon the origin of ores. The special part, after a brief review of the chief epochs of ore formation, includes condensed descriptions of the chief mining districts wherein are produced iron; gold and silver; copper; pyrites and native sulphur; lead and zinc; aluminum, manganese and quicksilver; antimony and various minor metals. Only the United States proper is treated in detail, but a few paragraphs on Alaska, Cuba, Porto Rico and the Philippines conclude the book proper. There is also a glossary, English into German, of geological, mineralogical and metallurgical terms.

For the second part of the work the author has read carefully and presents a very good brief review of the more important districts. He has drawn upon the mining monographs of the U. S. Geological Survey, not only for much of the text, but also for many cuts. Under the more important metals the districts are taken up by States. The matter is generally uptodate, although in one or two instances an improvement might be introduced. Under copper, Arizona receives several pages, but nothing is said of the new porphyry coppers, Miami, Ray and others. The Geological Survey has indeed not taken these up as yet, but in the technical press for a year or two past, much has been said about them. Again, under Utah, the Bingham porphyry coppers deserve more extended mention. They are the mainstay of Utah's production.

In the glossary a few corrections would make the definitions correspond better to American usage. Under "fault," for instance, "thrust" is not entirely a synonym. Most faults are produced by tension. Hade is not the same as dip, but is the angle made by the fault plane with the vertical, and is the complement of dip. Deflation is the removal of loose materials by the wind, and is not synonymous with degradation.

The general introductory part of the book, when not arousing indignation, which would be silly, will excite much amusement. There is news for B. B. Thayer, John Gillie and the other good people of Butte on p. 4. Rendered literally, the third paragraph runs as follows: "As a copper-producing State, Arizona has stepped into the place of Montana (Butte district), and the orebodies of Globe, Bisbee and Clifton-Morenci have knocked those of Butte out of the ring. At present Butte can be considered as emphatically dead, since, because of the strife over wages, which has already prevailed for quite a long time between the men and the mine owners, all the mines are closed down." The chief trouble at Butte in late years was caused by a row between two labor unions, in which the wicked mine owners, of Doctor Henning's imagination, had little share, and whose effect was not widespread.

There is more matter in Doctor Henning's chapter on the administration of the mining law, which ought not to remain entombed in the German, and lose its opportunity for arousing dormant consciences. Thus, beginning on p. 18, we find:

"How is, now, this system of mining law administered in the United States, and what is done for the well-being of the workingmen?

"Whoever knows the real conditions of this land, the immeasurable corruption of *every* official of the Government (*Beamten*), the brutal conduct of great aggregations of capital, and their reckless exploitation of those who possess less, will understand without further comment, that it is out of the question to talk of a strict enforcement of the laws and statutes of such a country as the United States. The laws are printed in the law books, but Big Capital plants itself on the maxim that might is right. Proof of these statements could be adduced from the occurrences in Cripple Creek in 1894, 1903-4, in the Cœur d'Alenes in 1898-99, in Goldfield and elsewhere, into whose elaboration we need not here go further."

"Just as bad is it with regard to protection of the workmen. The miners are not, as in Germany, a special and particular class, protected by the law. On the contrary, they come from every possible calling. We find that before they took to pick and shovel, they were bakers, butchers, brewers, masons, quarrymen, teachers (!); in short, everything except what they ought to be. There is, moreover, no lack of nationalities; there are working in the mines Swedes and Norwegians, Italians, Greeks, Germans, Croats and Slavs (the last named especially in the coal mines); but very seldom an American. That one must expect from such people as these no sort of mining knowledge, goes without the saying. The frequently observed, purposeless and planless operation of mines, is only an illustration of the incompetence of the available operating talent. With the foremen it is hardly better; naturally in the course of their duties they acquire a certain local knowledge; they know the ore of their districts, but beyond this their knowledge does not reach."

The author next addresses himself to the many accidents which have occurred in the last 20 years, and to the fact that dependents upon the men who lose their lives receive, if they are lucky, $150 to $200. He notes with approval the changes for the better through the Bureau of Mines, and finally concludes in italicized type:

"Beyond all other reforms, however, it is necessary that an educated mining class, possessing a special interest in their calling, should be employed in the mines, instead of the hitherto indifferent and in largest part incompetent class of labor. And further, that all the mines, as well of coal as of ores, should be supervised by incorruptible Government officials, who are not in the pay of a corporation or a trust, and who have only the welfare of their fellowmen and the general weal before their eyes as the guiding star of their calling."

After reading this graceful acknowledgment of the hospitality extended by America to a German who, strange to say, still resides with us, one cannot help wondering how it is that the American mining industry manages to exist amid all this incompetence and corruption, and how costs are kept down and wages up with such low-grade ores as were never touched before.

As on one or two former occasions, the small buyer or consumer has assumed a position of some importance in the steel trade. Lately he has been very much in evidence and his purchases have amounted to a very considerable total; in fact they have been the main support of the trade and have kept up the rate of production at the mills. Evidently the small buyer is a rather obtuse person who does not appreciate as he ought to do the advantages of a controlled market and an even range of quotations.

Metallics

When boards have become dished, that is, hollow on one side and rounded on the other, they may be straightened by exposing them in the sun, round side up.

It is often unwise to run the exhaust steam from a mine pump into the sump, as the temperature of the water in it may be raised so high that the pumps will refuse to work.

To clean steel tapes that are badly rusted, the use of a mixture of lubricating oil and cement is efficient. While no particular proportions are necessary, it should not be so thick that difficulty results in using it. Care should be taken not to rub too hard as the action is powerful and, used without judgment, wears off the metal.

The Utah Copper orebody is covered with a capping from 40 to 200 ft. thick. The steam-shovel operations now extend through a vertical hight of 1500 ft. There are 20 levels, 75 ft. or less apart, and lettered from *A*, the main level, to *U*. The equipment used in these operations is 25 steam shovels, 53 locomotives and 408 cars; with this, 750,000 cu.yd. of material per month are moved.

In determining the alkalinity of cyanide solutions a convenient standard to use is made up of 7.875 grams of oxalic-acid crystals per liter; 1 c.c. of such a solution is equivalent to 0.005 grams of NaOH or 0.01 per cent. when 50 c.c. of cyanide solution are taken for titration. Total alkalinity is obtained by direct titration using phenolpthalein indicator; for protective alkalinity the cyanide must be neutralized before the above procedure.

The following method of permanently marking boundaries of mineral claims has been found effective: If the point to be set is a section corner the correct lines are run out to an intersection and a hole about 2½ ft. deep and 18 in. in section is made at the approximate intersection. The bottom of this hole is lined to a depth of several inches with egg-size crushed rock. A ¾-in. round iron pin is set in the hole on the intersection and the hole is filled with a rich concrete to within 2 in. of the top, the remaining 2 in. being surfaced with neat cement. At the time the intersection is run out, a stake with tack should be set on each side of the hole on each line. By means of strings stretched between tacks the pin is shifted and a punch mark made in the correct place. The pin is permitted to project about 1 in. above the concrete. While the surface of the cement is still soft enough, lines are made with a sharp stick, indicating the correct position of the section lines, and in each quarter are written the numbers of the corresponding sections. At the bottom of the slab are written the date and name of man who set the monument. This constitutes a permanent and legible "corner."

By The Way

There seems to be no limit to the iniquity of American trusts. Now, it is reported from Australia that the world's radium market is controlled by an American syndicate. Radium is an article of such general requirements in commerce and the arts that we thought that it at least might escape the attention of monopolists.

In replying to certain English theorists who criticize the Indian government because it does not coin more gold and fewer silver rupees, Samuel Montague & Co., of London, mildly suggest that in a population of 300,000,000, where the bulk of the wage-earners have incomes under $50 per year, there is not much demand for gold coin. A silver rupee or two is quite enough to fill the weekly pay envelop.

The copper mines of Mt. Sinai were worked by the ancient Egyptians, and according to Doctor Berthelot, there is practically no copper mineral left in the ancient workings. Operations were abandoned there about 1200 B. C. That subdivision of labor is not a new thing is shown in the records of the Egyptian expeditions to work these copper deposits. There were not less than eleven grades of inspectors and eight distinct classes of skilled workmen. One expedition sent out during the regime of Rameses IV, consisted of 8000 men.

In the inclined shafts in the Lake copper mines, wooden rollers are placed in the skiproad at varying intervals to support the hoisting rope. These rollers rest in bearings and are so well greased in the deep shafts where a high hoisting speed is maintained that even in the middle portion of the shaft, the rollers, when set in motion by an ascending skip, continue to revolve until the same skip descends and the moving rope changes the direction of rotation of the roller. This movement of the roller is accompanied by a peculiar humming noise that immediately catches a stranger's ears.

The "oil trust" is now reduced to vulgar fractions. Since Sept. 1 the mathematical labor, which the force of clerks having in charge the distribution of the 33 subsidiaries of the Standard Oil Company of New Jersey, have had to perform, is illustrated by the list of fractions showing just what proportion of each share of each subsidiary company goes to the holder of a share of stock in the Standard Oil Company of New Jersey. The "trust" had issued 983,383 shares, and for each share of stock in the Standard Oil Company of New Jersey the stockholder will get so many 983,383ds of a share in each of the 33 subsidiaries. For those who are not shareholders the matter is chiefly of interest as a list of the subsidiary companies of Standard Oil. These are as follows, the figure given after the company being the numerator of a fraction, the denominator of which is 983,383 in each instance: Atlantic Refining Company, 49,996; Borne-Scrymser Company, 1995; Buckeye Pipe Line Company, 199,994; Chesebrough Manufacturing Company Consolidated, 2777; Colonial Oil Company, 2493; Continental Oil Company, 2995; Crescent Pipe Line Company, 59,997; Cumberland Pipe Line Company, Inc., 9985; Eureka Pipe Line Company, 49,994; Galena-Signal Oil Company, pref., 16,875; Galena Signal Oil Company, com., 55,919; Indiana Pipe Line Company, 99,994; National Transit Company, 509,033; New York Transit Company, 49,994; Northern Pipe Line Company, 39,994; Ohio Oil Company, 599,994; The Prairie Oil and Gas Company, 179,974; Solar Refining Company, 4994; Southern Pipe Line Company, 99,994; South Penn Oil Company, 24,995; South West Pennsylvania Pipe Lines, 34,996; Standard Oil Company (California), 249,995; Standard Oil Company (Indiana), 9990; Standard Oil Company (Kansas), 9993; Standard Oil Company (Kentucky), 9972; Standard Oil Company (Nebraska), 5995; Standard Oil Company of New York, 149,996; Standard Oil Company (Ohio), 34,994; Swan & Finch Company, 994; Union Tank Line Company, 119,993; Vacuum Oil Company, 24,998; Washington Oil Company, 7143; Waters-Pierce Oil Company, 2747; Anglo-American Oil Company, Ltd., share for share. A holder of one share of Standard Oil, for example, must prepare on Dec. 1 to receive 994/983,383—or about 1/1000—of a share in the Swan & Finch Company. This micrometrical job will not worry many of our readers, and Standard Oil shareholders can afford to hire clerks to do it for them.

The new rebel government in China has doubtless observed the workings of our own government and means to improve upon them. One of its first measures is an anti-trust law, which takes the form of an edict issued by Li Yuan Kung, the commander of the army of Hu-Peh and at present the head and front of the government. The law is brief, clear and direct in its terms, reading as follows: "Those who deal with merchants unfairly are to be beheaded. Those who interrupt commerce are to be beheaded. Those who attempt to close the markets are to be beheaded. Those who maintain the prosperity of commerce are to be rewarded." The last clause, perhaps, might have been omitted, since "those who maintain the prosperity of commerce" generally manage to secure their own rewards. One notable advantage of the law is that it obviates legal delays. When a sentence under this law has been carried out there will be no appeal to the Supreme Court.

Bureau of Mines Appropriations

The following appropriations (with comparison of appropriations actually made for the current fiscal year) have been requested for the U. S. Bureau of Mines:

For the general expenses of the Bureau of Mines, including the pay of the director and the necessary assistants, clerks and other employees in the office at Washington, D. C., and in the field, to be expended under the direction of the Secretary of the Interior; $74,300 for the coming year, $54,000 for the current year.

For the investigation of the causes of mine explosions, methods of mining, especially in relation to the safety of miners, the appliances best adapted to prevent accidents, the possible improvement of conditions under which mining operations are carried on, the use of explosives and electricity, the prevention of accidents and other inquiries and technological investigations pertinent to the mining industry; $360,000 for the coming year, $310,000 for the current year.

For the analyzing and testing of the coals, lignites and other mineral-fuel substances belonging to or for the use of the United States; $135,000 for the coming year, $100,000 for the current year.

For investigation into the treatment of ores and other mineral substances, with special reference to prevention of waste in mining, and utilization of important mineral resources; $100,000 for the coming year.

For the investigation of coals of Alaska with reference to their mining, transportation and utilization, to be immediately available; $50,000 for the coming year.

For salaries of two mine inspectors, authorized by the Act, approved March 3, 1891, for the protection of the lives of miners in the Territories, including Alaska; for per diem, subject to such rules and regulations as the Secretary of the Interior may prescribe, in lieu of subsistence at a rate not exceeding $3 per day each while absent from their homes on duty, except while in Alaska, when such allowance shall be at the rate of $5 per day, and for actual necessary traveling expenses of said inspectors, including necessary sleeping-car fares; $9500 for the coming year; $9500 for the current year.

For technical and scientific books and publications; $2000 for the coming year, $2000 for the current year.

Toward the construction of a fireproof building for the experimental work of the Bureau of Mines, the cost not to exceed $200,000; $50,000 for the coming year.

For the purchase or lease of the necessary land where and under such conditions as the Secretary of the Interior may direct, for the headquarters of five mine-rescue cars, and for the construction of the necessary railway sidings on the same, $4000; provided that the Secretary of the Interior is authorized to accept any suitable land that may be donated for said purpose; $4000 for coming year.

The total appropriation is $784,800 for the coming year, as compared with $475,500 for the current fiscal year.

Cripple Creek Drainage

DENVER CORRESPONDENCE

On Friday night, Nov. 11, at a point 15,956 ft. from the portal of the Cripple Creek deep-drainage tunnel, a large flow of water was struck and so suddenly that some of the men employed barely escaped with their lives. At present the flow is about 12,000 gal. per min. from the portal, but it will probably decrease somewhat from that. In the C. K. & N. property, just above the drainage tunnel on Beacon hill, it is stated that the water has dropped 70 ft. during the last four days. The Portland mine is said to be dry in its lowest workings, which will save $10,000 per month in pumping expenses. The El Paso mine is also dry and work will be commenced at once in the 1000-ft. level. No official measurements of the lowering of the water in the mines have yet been taken but it is said to be receding in all but the extreme eastern mines of the district.

To date the approximate cost of the tunnel has been $545,000 and it was commenced in July, 1907; the depth of the tunnel below the average water level in the mines of the district is about 730 ft. Its course is north 44 deg. 20 min. east for 14,845 ft. to a point 65 ft. east of the main shaft of the El Paso mine on Beacon hill and thence north 70 deg. east toward the Vindicator shaft on Bull hill. At the heading where the work is going on the rock is comparatively dry. Whether the whole district will be permanently benefited by this new flow of water, will be definitely known in a few days.

New Nipissing Mill

COBALT CORRESPONDENCE

The Nipissing company has broken ground at Cobalt for a 200-ton plant to treat the large quantity of low-grade ore developed on the property. In general the process will consist of crushing by stamps and tube mills, followed by amalgamation and cyaniding.

The treatment is an outgrowth of experimental work extending over nearly a year which has been carried on under the supervision of Charles Butters & Co. High-grade ore and jig concentrates will be treated at the present high-grade plant by the combined system of amalgamation and cyaniding, now employed with such highly satisfactory results. Ore will be handled almost entirely by aërial tram from the various shafts. The new mill will be situated on the high ground to the east of Cobalt lake, generally known as the Nipissing hill. It will partially face the town and the tailings will flow into Herbert pond. The date of completion is set for Nov. 1, 1912.

E. P. Earle, president of the Nipissing, recently stated that owing to the new method of treatment the company's ore reserves had been practically doubled. Heretofore the low-grade ores in the mine and on the dumps were not included in the estimates, as the company had no mill to treat them. It is estimated that with this process an extraction of about 90 per cent. can be made at a milling cost of $3 per ton.

Camp Bird, Ltd.

The tenth ordinary general meeting of the Camp Bird, Ltd., was recently held in London. The accounts show a profit for the year ended April 30, 1911, of £267,689. Out of this sum £220,000 was paid as dividends. Since the Camp Bird mine was bought by the English company it has produced £3,750,000, or $18,225,000, and paid £1,500,000 in dividends. Every subscriber to the amount of £100 has received £175 in dividends, and his stock is still worth £150. Efforts have been made to secure another mine near Ouray, so that the surface plant and officers can be kept at work.

As a consequence of the failure to discover new orebodies there is a rapid depletion in ore reserves, and during the year the increase over the estimates of one year ago is less than in any other fiscal period in the history of operations. Ore reserves are estimated at 38,415 tons.

The total cost of mining and milling, exclusive of depreciation on plant and machinery, was $8.82 per ton, divided as follows: Mining and development, $3.26; tramming, 19c.; stamp-mill, $1.12; cyaniding, 58c.; shipping and selling, $1.77; general expenses, $1.90 per ton.

The running time in the stamp mill was 351 days and in the cyanide mill 349.6 days. A saving of 94.87 per cent. of the gold in the crude ore was made. Of the total metals extracted 64.32 per cent. was obtained by amalgamation, 28.81 per cent. by concentration and 6.87 per cent. by cyanidation. The gross value of the metals recovered was as follows: Gold, $1,685,980; silver, $71,435; lead, $46,748; copper, $8408; total, $1,812,572, or $22.89 per ton. Owing to the character of ore treated the percentage of gold to total value and percentage of recovery by amalgamation are less than in previous years.

During March and April the road leading from the mills to Ouray was blocked to wagon traffic for 27 days, resulting in a congestion of concentrate requiring several weeks to move to the railroad.

Correspondence and Discussion

Cyaniding Concentrate

In the JOURNAL of Feb. 25, 1911, H. E. Durant, in an article entitled "Upward Leaching of Sand," states that, due to channeling and uneven percolation, some portions of the charge may escape thorough treatment with the result that the recovery of gold and silver is not as thorough as it might be. He claims that the low recovery from such patches of sand is apt to pass unnoticed because in sampling the residue, the dilution of the richer residue by that from which a high extraction has been effected, may be so great that the assay of the residue as a whole may indicate a thorough treatment of the entire charge.

This remark has brought to my mind the practice of returning slimed concentrate to the general mill slime for cyanide treatment. This practice is not common but is occasionally found in use. The usual procedure is to remove the bulk of the concentrate from the mill pulp by concentration tables. The table tailings are then classified as sand and slime for separate cyanide treatment, or the sand is reground and all the pulp treated as slime.

The table concentrates are reground in a separate grinder until of the desirable fineness, and then join the general stream of mill slime flowing to the agitators. When this system is in use, it is usual to find that the concentrates are reground until all the particles are much finer than the slime from the lighter constituents of the ore. In the particular mill I have in mind practically all of the concentrate, after regrinding, will pass a 500-mesh screen, while the gangue slime will all pass a 150- or 200-mesh screen.

This finely comminuted slime is returned to the stream of gangue slime and the whole treated by agitation in cyanide solution. The only function of the concentration tables is to remove only the heavy sulphides for extremely fine grinding. Is such practice to be commended? The reason that the concentrates are ground so extremely fine is that the gold or silver associated with the sulphide minerals is more difficultly soluble in cyanide solution. A finer state of subdivision is necessary, and usually a longer period of treatment than in the case of slimed gangue minerals. In the system under consideration the time of treatment of concentrate slime is not prolonged so it must be considered that the smaller size of the particles of sulphide minerals is sufficient to make the gold or silver associated with them, as readily soluble as that associated with the lighter minerals, a greater number of particles of which are larger.

Views, Suggestions and Experiences of Readers

Of course, if the quantity of gold or silver associated with the sulphides is small the difference in extraction might not justify the expense of separating and separately treating those minerals, but from the fact that tables are used and that the sulphides are separately reground, the difference in recovery must be considerable. It may be that such a treatment would give the maximum profitable recovery on certain very simple ores, but I am inclined to doubt it and claim that generally a separate treatment of the concentrate is preferable and more profitable. To support this argument it is only necessary to state that at most all the mills with which I am familiar, the residues from the cyanide treatment of concentrate usually contain enough gold or silver to make shipment to a smeltery profitable.

When the sulphides constitute a large proportion of the ore and do not contain a much greater quantity of gold and silver than the lighter portion the aspect is different. My argument considers especially high-grade concentrate, of which comparatively few pounds are separated from each ton of ore. To separate the sulphides, finely triturate and then return them to the general slime-treatment system is usually a questionable practice that can only be justified by substantial evidence that the sulphide portion of the final tailings contains no more gold or silver than the other portion.

The extraction of gold and silver from rich concentrate often can be improved by a chemical treatment preliminary to cyanidation, or it may be that unusually strong solution must be used or the extraction will be low. It is so much more often the case that some such special treatment is essential to high extraction that any ore, the sulphides in which readily yield the associated gold and silver by simple regrinding, so that the sulphides can be returned to the mill-slime stream, must be considered as extremely unusual.

The capital expenditure to provide a small plant for separate treatment of the sulphides can hardly be prohibitive at any mine. If the concentrate residue cannot be profitably shipped at present, it can be stored until some method of further treatment is evolved. Better store the sulphide tailings and concentrate at least a certain part of the inevitable loss into a comparatively small bulk rather than dilute it by mixing with the general slime tailing. There is always the possibility that progress in the art will permit treating the concentrate residue at a profit which would not be the case had the sulphides to be removed from the accumulated tailings of years of milling. The cost of handling a large bulk of tailings and concentrating the sulphides might equal the profit that could be made had the concentrates been separately cyanided and the residues stored separately. Once separated, it is better to keep the concentrates apart.

CLARENCE C. SEMPLE.

New York, Nov. 20, 1911.

Sampling Dredging Ground

It is the opinion of many mining engineers that the gold-dredging fields, so far as the western portion of the United States is concerned, have practically all been exploited by competent men, and the limits of the larger areas, at least, fairly well defined. Those areas which have been tested and are not already controlled by dredging capital are considered unlikely to furnish a field for profitable investment. However, there are others more optimistic, who are of the opinion that a great many tracts which have been examined and reported on unfavorably still retain great possibilities. Some of these will become a profitable field for the investor who will more closely investigate these properties and, by a thorough system of prospecting, fully determine the correctness of the results secured by former investigations. There are several reasons which might be advanced to show that this latter contention is based on a substantial foundation.

During the last 10 years no branch of the gold-mining industry has shown such great development and advancement as has gold dredging. The successful gold dredge of 10 or 12 years ago was a type which, when capable of handling 40,000 cu.yd. of material per month, was considered to have reached a state of perfection. The working costs of these earlier dredges varied from 8 to 15c. per cu.yd., according to the conditions encountered, and also the type of dredge used.

The dredge of today, under favorable circumstances, will handle material at a cost not to exceed 5c. per cu.yd. In many instances where the material is handled by the larger dredges, the work-

ing costs have been reduced to as low as 3c. per cu.yd. In addition, dredges are now under construction with a 16-cu.ft. bucket, with a capacity for the dredge estimated at 300,000 cu.yd. per month. These dredges are expected to further reduce the working costs.

PROSPECTING NEGLECTED

During the time the dredge has been reaching such a state of perfection, the amount of exploited and proved ground has been rapidly diminishing, and dredge operators are beginning to realize that they must look elsewhere if they are to remain in the business. As a result exploitation of lands which at one time were reported on unfavorably, must eventually occur.

Various makes of the churn drill have been used in the testing of these deposits, but the same general method of driving the pipe and extracting the core is used by all. This type of machine was primarily designed for use in the sinking of water wells, which simply requires that a hole of a certain diameter be sunk to a certain depth, with no necessity for accurate determination of the volume of material displaced by the pipe.

In the sampling of placer ground, the same general methods of procuring the sample by this drilling machine have been used for the last 10 years. While the dredges themselves have been improved the churn-drill method of sampling used in forecasting results has not been bettered. In fact, it is difficult to suggest a possible means of improvement for this particular class of machine. I think that the surest and safest method of avoiding future trouble in sampling would be, whenever possible, to eliminate the use of this drill in the investigation of previously rejected properties.

If the conditions surrounding the property to be sampled are such as to prohibit the use of the shaft method, the substitution of the rotating hand drill for the steam-driven churn drill will, I believe, be found advantageous. The methods used in procuring a sample by this machine are far superior to the heavy spudding and straight-driving methods employed by the steam machine and, as a result, the sample recovered is a more representative one. When operating the rotating hand drill the sinking of the pipe and the extraction of the core are carried on simultaneously, thus guarding against the highly objectionable feature of the plugging up of the drive pipe by the hard driving methods, which often results in a portion of the material being driven down and to one side, making the drill test show a low gold content.

DEFICIENCIES OF THE CHURN DRILL

When sinking a hole with the straight-driving churn drill, rocks which are too large to permit entrance into the drive pipe will be carried ahead of the drive shoe for a considerable distance before being displaced, and the sample extracted at this depth will not be representative. The rotating drill is equipped with a cutting shoe having sharp teeth, which, when encountering such rocks, either turn them so as to allow them to enter the pipe or else turn them to one side of the pipe, thus allowing the free action of the cutting shoe on the material immediately below this point; and the material instead of being forced ahead and to one side, will enter the pipe, thereby producing more accurate results.

The method of extracting the core from the pipe used in the operation of the rotating drill is superior to the method used by the churn drill. In the rotating-drill method, the sand pump is a combination drill and pump, which is of the ball-valve type, and immediately picks up the particles as they are cut and displaced by the bit, thus preventing the sliming of any portion of the core. As this method of drilling and pumping is continuous, and not of the sudden jerky variety, it serves as a preventive against the sudden inrush of water and fine material into the pipe, which so often occurs when the intermittent method of pumping employed by the churn drill is used.

ROTATING DRILL A GOOD SAMPLER

I had an opportunity of observing the accuracy of results secured by the rotating hand drill which was used in sampling two separate deposits, situated in different States, and the surrounding conditions of which were widely dissimilar. On one property a total of 69 holes had been drilled and the area included by these holes was dredged. In this case the returns per cubic yard as secured by the dredge coincided within 0.1c. of those secured from the drill tests. At the other property tested by this method the ground was afterward worked by sluicing and in this case the results were found to agree within 0.7c. for each yard handled.

In the above cases, the correctness of the samples taken was remarkable, and it would not be reasonable to expect to secure such accurate results in all cases. But it is my opinion, based on 10 years' experience in the handling of various types of drilling machines, that it is possible to secure a greater degree of accuracy in testing by the rotating drill than by any other drilling method.

Another advantageous feature connected with the rotating drill is its extreme mobility. There are properties, which on account of the excessive cost of placing a steam drill on them, together with the high operating cost of the drill, have been subjected to but a haphazard method of testing, and have often been abandoned before it was possible for the engineer to form any conclusions as to the adaptability or value of the property.

If a property is worth sampling, it is worth sampling well. Haphazard methods of testing are worse than useless. Unquestionably, drilling by any modern method is cheaper and more rapid than the method of testing by means of shafts, but, when drilling, it is not always possible to determine the exact character of the material through which the pipe is passing, particularly so as regards the size of the boulders encountered. Whenever possible to do so it is advisable that a few shafts be sunk on the property being tested, which, in addition to fully determining the character of material, will, by the washing of the excavated material, serve as a check on the results secured by the drill.

During the last few years dredges have been installed on properties once sampled and classed as undesirable; today these dredges are paying dividends to the owners. This was made possible, not only because of the decreased operating costs of the dredge, but also because the property was, upon a renewal of the testing, subjected to a more practical and thorough examination.

ROBERT F. LAFFERTY.

Leadville, Colo., Nov. 1, 1911.

Wood Fired Reverberatories

In Peters' new book, "The Practice of Copper Smelting," a copy of which I have just received, I am surprised to note that in the chapter on wood-burning reverberatories, little reference is made to Australian practice. Wood fuel has been used for more than half a century in the production of a large portion of the copper output of this country.

In the summary, the author states that he thinks there should be no difficulty in firing a furnace, measuring 12x20 ft., entirely with wood fuel. He is right; much larger furnaces have been used in Australia for many years. At the Silverspur mine, they have been used in sizes ranging from 17 to 40 ft. from bridgewall to skimming door, the last being the largest size now in use. Furnaces wider than 15 ft. have not been used at Silverspur, but, I believe, at Burraga, N. S. W., a furnace 50 ft. long is used.

No difficulty is experienced in heating these furnaces with wood; we use no other fuel and I would not hesitate to build a longer furnace if our conditions should make it desirable to do so. The ore is not easy to smelt and the matte fall is only 3.5 per cent. The 40-ft. furnace smelts 40 tons per 24 hours, nearly all of which has to be slagged.

EDGAR HALL.

Silverspur, Queensland, Sept. 22, 1911.

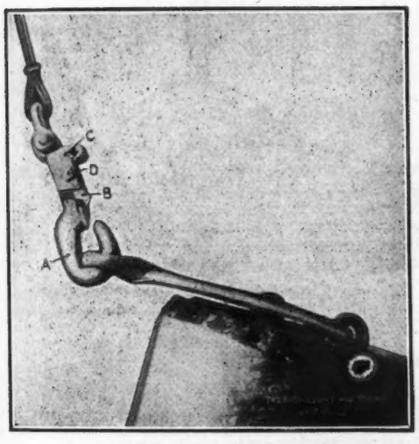
Details of Practical Mining

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

A Safety Hook for Hoisting Buckets

In the sinking of prospect shafts, the type of hook used for attaching the hoisting rope to the bucket is a matter of great importance, for upon it depends the safety of the men in the shaft. The accompanying illustration shows the details of the hook used at the Sand Grass shaft, at Tonopah, Nev. This hook was designed by William Bozarth, master mechanic for the Tonopah Mining Company, and it has



BOZARTH SAFETY HOOK

been found handy and perfectly reliable in its action. Reference to the engraving will show that it is absolutely impossible to detach the hook by accident.

The Bozarth hook, which is not patented, consists of the hook proper *A*, to which the latching piece *B* is secured by a sleeve *C* that slides along the square section of the shank of the hook. In the shank a recess is cut for the locking bar *D*, while in the latching piece is a similar recess which justifies with the recess in the hook proper when the snap is resting against the point of the hook. This locking bar *D* extends out beyond the sleeve about ⅜ in. on each side and there is a hole cut in the sleeve in which the locking bar can move back and forth. A flat spring behind the locking bar presses the bar forward against the hook proper. This spring is made narrow so as to allow the locking bar to run easily to one side or the other, thus preventing a jar from detaching the hook.

In order to unlock the hook, the locking bar for its entire width must be pressed snugly against the back of the recess in the snap or else the snap will not be free. This is done by grasping the ends of the locking bar between the fingers and pressing back squarely in its recess, by pulling outward and upward. In this way the hook is easily and quickly unlatched, but it seems that only by human agency can this combination of movements be accomplished. As soon as the snap is released its weight returns it to place and the spring closes the locking bar.

Michigan Change Houses

By P. B. McDONALD*

The Mary Charlotte Mining Company is completing a new change house at the Mary Charlotte shaft No. 2, at Negaunee, Mich. The building is of reinforced concrete of the type known as "hy-rib," and is patterned in this respect after the change house of the Penn Iron Mining Company, at Vulcan. It is 115x44 ft., is supplied with a number of 20-in. ventilators, and has a comparatively flat roof from which it is hoped that the wind will blow much of the snow. The construction is economical in that the rails used as vertical reinforcements in the walls are old ones, and the 6-in. columns, of which there is a row down the center of the building for supporting the I-beams in the roof, are of old pipe. The "hy-rib," which can be compared to a highly perforated metal sheet presenting a rough surface to receive plaster and with longitudinal ribs of doubled metal for stiffening, is fastened to the reinforcements in two thicknesses with a 4-in. air space between; on the outer sheet of "hy-rib" are plastered 2 in. of concrete and on the inner sheet is plastered 1 in. of concrete in which a little lime has been mixed. The "hy-rib" construction is becoming popular in the Michigan districts; it is strong, durable and when put on in two layers with an air space between makes a warm construction.

The change house of the Penn Iron Mining Company, at Vulcan, provides two lockers per man, one for underground clothes and one for street clothes; the lockers for underground clothes are airtight, and have a system of hot-air circulation for drying the clothes, entirely separate from the air in the change house proper. In this manner the building is not kept excessively warm in order to dry the wet underground clothes.

*Mining engineer, Negaunee, Mich.

High Grade Bullion from Precipitates*

By J. BOYD AARONS AND HERBERT BLACK

In order to find the best method of producing high-grade bullion from zinc-box precipitates extensive experiments were carried on at the Chaffers gold mine, West Australia. The usual procedure followed at cleanup is to send all the precipitate and short zinc to the acid vat, only the well washed long zinc being returned to the boxes. No scrubbing or screening of short zinc is attempted, it being desired to obtain the maximum amount of gold possible. After acid treatment, the finishing point being determined by the absence of action on the addition of acid, the diluted precipitate is sent to a small filter press where the pressed precipitate is given three or four washes of hot water in order to wash out the soluble sulphate. The cakes are air dried and dropped into shallow iron trays, weighed, and placed into cast-iron muffles, where the precipitate is subjected to either a roast at dull red heat or is merely dried. No screening of the dried or roasted precipitate is carried out, as smelting operations prove that the practice of screening sometimes adopted has no bearing on the production of high-grade bullion.

The roasted or dried precipitate after being weighed and sampled is mixed with flux as follows: 100 parts precipitate, 50 parts borax, 20 parts sand, and in some cases 7 to 10 per cent. of niter is added to the charge. This mixture is melted in clay liners in plumbago cru-

*Abstract of an article in *Monthly Journ.* of the Chamber of Mines, West Australia, Aug. 31, 1911.

cibles No. 100. When fusion is quiescent the charge is poured into conical molds producing high-grade buttons of gold bullion averaging about £4 4s. ($20.40) per oz., which are subsequently melted in small plumbago crucibles No. 30, and the gold poured into bar molds of 500 oz. capacity.

An investigation of the physical nature of the roasted or dried precipitate and of the bullion under consideration makes it plain that it is easier to produce high-grade bullion direct from the roasted or dried precipitate than to produce low-grade bullion and afterward refine it; moreover, there is less chance of loss where the refining is carried out through the medium of the flux than in the refining of the metal.

Some authorities are emphatic on the necessity of a dull-red heat for roasting the precipitate before smelting operations. In the event of the acid treatment being imperfect, either owing to insufficient acid, or to a protective coating of insoluble lead or calcium sulphate deposited on the zinc, a roast would be necessary, or the use of clay liners and niter flux would have to be resorted to in order to obtain high-grade bullion.

The object of roasting at dull-red heat is to oxidize any metallic zinc present, but roasting opens an avenue for loss of gold through the gold being carried over with the copious fumes of zinc; therefore, it is advisable to give a thorough preliminary acid treatment and thus avoid the necessity for roasting at red heat. Provided that the acid treatment be practically perfect, the drying of the precipitate at 100 deg. C. and subsequent melting in clay liners and plumbago pots is all that is necessary to obtain bullion of high grade.

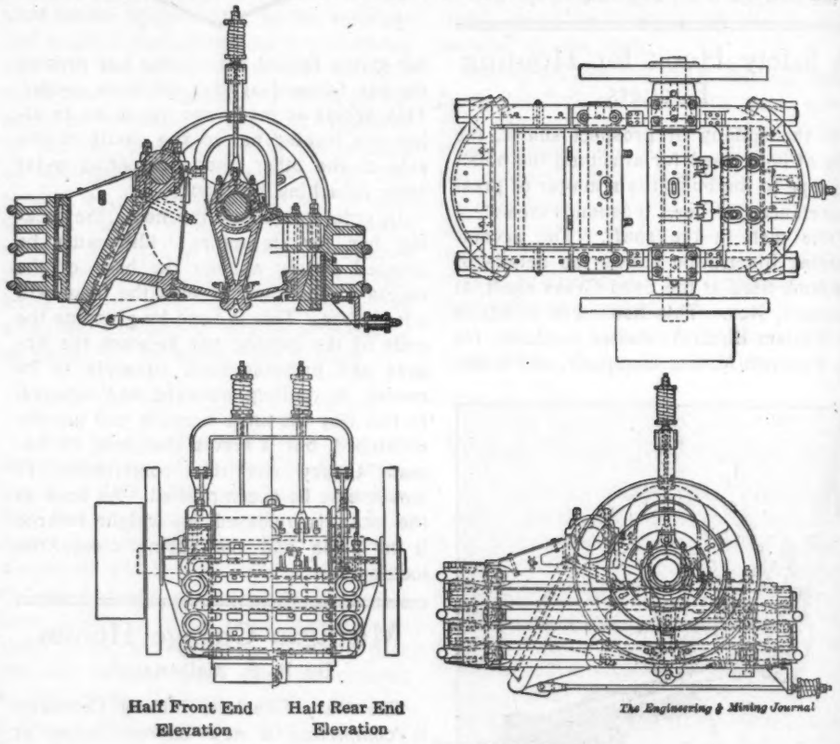
With regard to base metals present in the precipitate under consideration, the only troublesome base is apparently zinc, which is dealt with as above. Practically no copper is present and proof of this is seen by the high-grade bullion produced by the use of liners without niter flux. Were copper present in this precipitate, then the fine filaments of this base metal would remain unchanged throughout the acid and wash treatment and metallic copper would come down in the bullion unless precaution were taken for the elimination of this base. The use of clay liners and niter flux would result in high-grade bullion. Experience has proved that the precipitate containing a large percentage of copper which in plumbago crucibles only gave bullion worth £2 2s. $10.20) per oz. was raised to £4 3s. ($20.16) per oz. by the above method. The practice of washing zinc shavings in a solution of lead acetate often accounts for the presence of lead in the bullion. This base may be removed by liners in plumbago crucibles using niter as flux but the method is slow and tedious. Manganese dioxide is often added to facilitate operations, and is preferable, because the elimination of the lead is performed more quickly.

The Calumet Crusher

The Calumet crusher is a special form of the Blake type, of extraordinarily light construction for its size of jaw opening, 24x48 in. It weighs 40 tons, while a 24x36-in. Blake of a standard form of construction will weigh as much. The details of the weights of the different parts are: Crusher frame, caps, tail block, plates and zinc, 32,287 lb.; large bolts and nuts, 6103 lb.; pitman shaft and nuts, 8420 lb.; all other parts, 32,020 lb., making a total of 78,830 lb. as originally designed, but owing to some small additions and different form of plates now used, this weight has been increased by about 1000 lb. This extraordinary lightness, is obtained by casting the frame in one piece, and reinforcing it and binding it together by means of bolts, as is shown in the accompanying detailed drawings. In this way the frame itself can be made to weigh only about 14 tons.

These reinforcing bolts are put on hot, as well as the nuts with which they are tightened, so that there is a considerable initial compression in the frame casting which makes it much stronger in resisting rupture. The toggle is made of a special shape so that a rolling action is obtained at the ends instead of the grind that wears the ordinary toggles so rapidly. Another feature of the construction is the angle of the face of the jaw piece. This is much less than in most crushers, and consequently there is less clogging, less breakage and an increase in capacity. The jaw piece has a travel of one inch.

One of the novel features of the Calumet crusher is that the weight of the pitman is taken from the bearings by suspending it by springs from a yoke bolted to the frame of the crusher. In this way the weight of the pitman is taken from the babbitt in the bearings, and the crusher can be run without undue heating. The tension on these springs is adjustable, lock nuts being used to hold the adjusting nut in position, and the tension is regulated so that the pitman just does not float in its bearings; as a consequence, but a small quantity of oil is used.



DETAILS OF THE CALUMET ROCK BREAKER

Smooth jaw faces are used as more ore can be crushed with them than with corrugated plates, although the ore is hard and tough, being bound together by native copper. On the crushers used for conglomerate ore, manganese-steel plates are used, while on the crushers for amygdaloid ore, chilled steel is more satisfactory.

A special feature of the crusher is the drilling of a hole in the end of the shaft to show the position of the eccentric. Then in case a mass of copper, or anything else, clogs the crusher the attendants can determine, by looking at the end of the shaft, the position of the eccentric and see which way to turn the flywheel so as to loosen the jaws and remove the mass of copper.

Since this detail has been added to the crushers it has been possible to start a crusher again within 20 minutes after choking, while formerly it took much longer.

Proportions of Air Mains and Branches

The accompanying table, showing the number of branch pipes of a given size that can efficiently be supplied with air from a main of given size, is taken from a bulletin issued by the Green Fuel Economizer Company and is based upon the laws of the flow of air through pipes. The figures in the vertical columns to the left are the diameters of the mains; the numbers at the head of the vertical columns, the diameters of the branch pipes; the other numbers in the table show the number of pipes of the diameter designated at the top of the vertical column, equal to one pipe of diameter designated in the column to the extreme left on the same horizontal line.

EQUALIZATION TABLE FOR PIPES

Diameter of Mains	Diameter of Branches															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2	5.7	....	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	16	2.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	32	5.7	2.3	...	...	...	...	...	...	...	...	...	...	...	...	...
5	56	9.7	3.6	1.8	...	...	...	...	...	...	...	...	...	...	...	...
6	88	16	5.7	2.8	1.6	...	...	...	...	...	...	...	...	..	...	...
7	129	23	8.3	4.1	2.3	1.5	...	...	...	...	...	...	...	...	...	...
8	180	32	12	5.7	3.2	2.1	1.4	...	...	...	...	...	...	...	...	...
9	244	42	16	7.6	4.3	2.8	1.9	1.3	...	...	...	...	...	...	...	...
10	317	56	20	9.9	5.7	3.6	2.4	1.7	1.3	...	...	...	...	...	...	...
11	402	71	26	12	7.0	4.5	3.1	2.2	1.7	1.3	...	...	...	...	...	...
12	501	88	32	16	9.0	5.7	3.8	2.8	2.0	1.6	1.2	...	...	...	...	...
13	613	107	39	19	11	6.9	4.7	3.4	2.5	1.9	1.5	1.2	...	...	...	...
14	737	129	47	23	13	8.3	5.7	4.1	3.0	2.3	1.8	1.5	1.2	...	...	...
15	876	152	56	27	16	9.9	6.7	4.8	3.6	2.8	2.2	1.8	1.4	1.2	...	...
16	1026	180	65	32	18	11	7.9	5.7	4.2	3.2	2.6	2.1	1.7	1.4	1.2	...
17	1197	208	76	37	21	13	9.2	6.6	4.9	3.8	2.9	2.4	2.0	1.6	1.4	1.2
18	1375	239	88	43	24	16	10	7.7	5.7	4.3	3.4	2.8	2.3	1.9	1.6	1.3
19	1580	275	100	49	28	18	12	8.8	6.5	5.0	3.9	3.2	2.6	2.2	1.8	1.5
20	1775	312	114	56	32	20	14	9.9	7.4	5.7	4.5	3.6	2.9	2.5	2.1	1.7
21	1985	345	130	61	35	22	15	10	8.4	6.3	5.2	4.1	3.2	2.6	2.3	2.0
22	2250	398	145	71	41	26	18	13	9.3	7.2	5.7	4.5	3.7	3.1	2.6	2.2
23	2525	460	160	77	47	29	20	14	10	7.8	6.2	5.0	4.1	3.4	2.8	2.4
24	2800	493	180	88	50	32	22	16	12	8.9	7.6	5.7	4.6	3.8	3.2	2.9
25	3060	543	202	97	55	35	24	17	13	10	8.0	6.4	5.2	4.2	3.5	3.1
26	3425	590	219	108	62	39	27	19	14	11	8.6	6.9	5.7	4.7	4.0	3.4
27	3738	677	243	121	68	43	29	21	15	12	9.6	7.5	6.1	5.1	4.3	3.6
28	4100	725	265	129	74	48	32	23	17	13	10	8.3	6.8	5.7	4.8	4.1
29	4440	800	289	141	79	52	35	25	19	14	11	9.1	7.5	6.2	5.2	4.4
30	4898	864	315	151	88	56	38	28	20	16	12	9.9	8.0	6.7	5.7	4.7
31	5312	920	344	168	96	59	40	30	22	17	13	10	8.9	7.4	6.1	5.1
32	5631	1070	374	184	103	63	42	32	23	18	14	11	9.3	8.0	6.5	5.7
33	6154	1140	401	196	109	70	45	35	25	19	15	12	10	8.5	7.1	6.0
34	6675	1208	433	212	119	76	51	37	27	21	16	13	11	9.1	7.6	6.4
35	7075	1280	470	229	127	82	56	40	30	23	18	14	12	10	8.4	7.1
36	7735	1355	497	242	138	88	60	43	32	25	19	16	13	11	8.9	7.6
37	8265	1435	537	260	146	94	64	45	33	26	20	16	13	11	9.3	7.9
38	8715	1625	575	279	157	100	68	49	37	29	22	18	14	12	10	8.6

For example, it is desired to find the diameter of the main equivalent to thirty 8-in. pipes. Follow down the vertical column for 8-in. pipes until the nearest number to 30 is found, then follow out horizontally to the left-hand column. The number there found will be the diameter of the main required, in this example 31 inches. Conversely, the number of pipes of a given section that a given main can supply, can be determined from the table.

Steam Hoists for Shallow Mines

By Sven T. Nelson*

Several years ago, in the iron-ore fields of northern Minnesota, a large number of mining companies were hoisting from comparatively shallow depths with primitive slide-valve engines of the poorest fuel economy. By shallow mines are meant those from 200 to 1200 ft. deep. The average load handled, exclusive of the rope and skips, is five tons, and ordinary service requires a speed of 700 to 1000 ft. per min.

Some 30 years ago corliss engines or engines with an automatic cut-off were just being introduced for hoisting purposes. These new plants were chiefly in the Lake Superior copper district. They consisted largely of regular mill engines, purchased from the corliss engine builders; some were furnished with gears and pinions and some were not. The drums were built up of wood at the mine.

With these exceptions, the hoists then in use were equipped with slide-valve engines of the commonest type. Crude as were the first corliss hoists, and numerous as were the objections and jibes cast at them on account of their "trappy" and "complicated" mechanism, the reduction in fuel consumption which they secured by means of the automatic cut-off was so great, that the slide-valve engine was soon crowded from the field.

The iron companies of the northern Michigan field were also impressed with the fact that corliss hoists did their work on from one-third to half the fuel required for the slide-valve pattern. The first engines installed at any of the iron mines with a detachable valve gear for automatically closing the steam valves were not of the corliss type, but of the same type as an engine that is still built at Fitchburg, Mass., by the Brown Engine Company. A modified type of the Brown engine was adopted by one of the hoisting-engine manufacturers of that time, and several of them installed. These engines were found to be satisfactory and were economical on low steam pressures. However, they did not lend themselves so successfully as the corliss type to the constant increase in steam pressure, which took place with improvements in boiler manufacture.

From this time the corliss engine, became the standard for deep hoisting practice throughout the Lake Superior region and the western mining fields as well. By deep mines are meant those ranging from 1000 to 5000 feet in depth.

With the knowledge and experience gained in designing hoists for deep mines at their command, the engineers attacked the problem of securing hoisting economy for shafts of more moderate depths.

It is out of the question to use first-motion corliss hoists for this work, on account of the limitations in speed of corliss valve gear requiring engines unduly large for the service required. In shafts, only a few hundred feet in depth after the load is accelerated, but a few revolutions of the engine will be made with the automatic cut-off in action, so that a direct-acting corliss hoist would be not only needlessly high in first cost, but more extravagant in fuel than a slide valve engine of the simplest type.

Corliss-geared hoists were tried for some of these shallow mines, but as in the case of first-motion plants, engines disproportionately large had to be furnished, to keep the number of revolutions as low as possible. Difficulty was also incurred in certain fields, in securing engineers that would and could take proper care of a corliss engine; so that mine managers continued to use the old-fashioned, plain slide-valve hoists, with their excessive cost for fuel.

After much study, the type of hoist known as the automatic slide-valve hoist was worked out, and has now been in satisfactory use for several years. That this design fulfils the conditions,

*Chief engineer, hoisting engine department, Sullivan Machinery Company, Chicago, Ill.

will be seen readily from a study of the continuous indicator diagram taken from the hoist of this pattern at the Webb mine of the Shenango Furnace Company, at Hibbing, Minn.

The hoist consists of two slide-valve engines each 16x18 in. geared to a single drum six feet in diameter by six feet long. It takes steam at 145 lb. boiler pressure and runs at 140 r.p.m., hoisting a load of five tons of ore in addition to the weight of the rope. Two skips are used in balance, so that their weight is offset. The diagram represents the entire trip from the start at the bottom to the dump. Each diagram indicates one revolution of the engine. The gear and pinion ratio is four to one, so that the engines make four revolutions to one of the drum. As there are 57 diagrams, the depth of the shaft is 269 ft. and the load is hoisted in 14 revolutions of the drum.

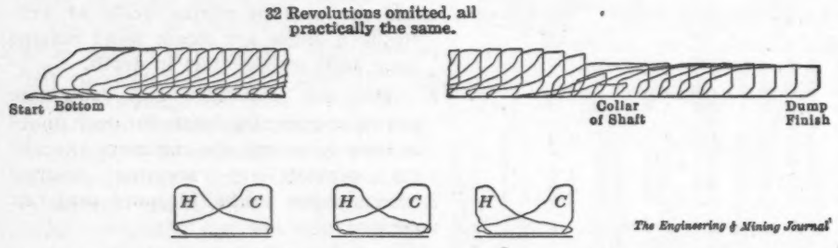
In starting from the bottom, it should be noticed that the first diagram takes steam three-fourths of the stroke, the second about five-eighths of the stroke, and the third about one-third of the stroke; at this point the acceleration is completed. From there on, up to the point referred to as "collar of the shaft," the engine is cutting off at about one-fifth. At this point there is a drop in pressure, as indicated by the diagram, and the length of admission of steam to the cylinder. When this point is reached, the engineer closes the throttle partially to slow up for the dump; this puts the automatic cut-off out of action, in precisely the same manner as the dashpots cease to drop when a corliss engine is being retarded. From the point called "collar of the shaft" to the point referred to as the "dump and finish" the regular slide-valve action is secured, just as would be the case for the entire distance from top to bottom were it not for the automatic cut-off.

The three individual diagrams, below the continuous diagrams, were set aside from the continuous diagram so that users of engines not familiar with continuous diagrams can tell from these the action of the valve gear and the steam distribution. The slightly jagged appearance of the lines is due to the high speed at which the engine was running and a small amount of water in the indicator pipes, which caused the indicator pencil to chatter.

It should be noted that in hoisting engines, hand adjustment of the point of cut-off is out of the question. It would require an engineer's constant attention, to give his engine steam for the entire stroke when starting the load; to set the valves at the proper point of cut-off when the load is under full motion, and to lengthen the cut-off again, at the end of the trip. This is obviously impossible, nor would it be possible for the engineer to set the cut-off at its most economical point each time, owing to variations in steam pressure and load.

The engines of the Webb mine hoist and of others of this type, are of the plain, double, slide-valve pattern, and the valve gear places no limit on the speed at which they can be run. The mechanism controlling the automatic cut-off is so arranged that no extra thought or action is required of the engineer. When the throttle lever is pulled, the first two or three inches of its movement opens the main throttles, admitting steam during the entire stroke to start the load from the bottom, as shown by the first cards. As the lever is pulled back, it admits steam to an auxiliary valve mechanism and cylinder. The piston of this cylinder actuates a crank and shaft which in turn moves a vertical rack at the rear end of each cylinder. These racks engage pinions, one at the outer end of each cut-off valve stem. The admission of steam to the auxiliary cylinder therefore automatically places the main valves in the position of shortest cut-off, and this action is shown in the cards as above described. At the end of the trip, the reversal of the lever, to close the main throttles, admits steam to the opposite side of the piston in the auxiliary cylinder, and the cut-off is restored to its first position.

The hoists are built with drums ranging from six to eight feet in diameter, and with engines from 14x14 in. to 16x24 in., adapted for steam at 150 lb. pressure. The hoisting speeds range from 700 to 1000 ft. per min. and the loads from five to seven tons.

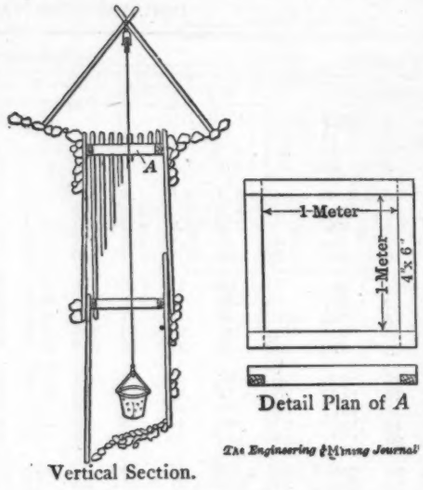


CONTINUOUS DIAGRAM FROM AN AUTOMATIC CUTOFF HOISTING ENGINE

Test Pit for Dump Sampling

BY WALTER R. HODGE*

It is quite a problem to sample large dumps properly. Surface sampling is eminently unsatisfactory no matter how thoroughly it is done, for the inside of the dump must be reached to gain a fair estimate of the grade of the ore contained in it. One way of getting to the inside of the dump is illustrated in the accompanying sketch, and is the method that was used by A. B. Carpenter in his examinations in and about Guanajuato, Mexico. The pit shown here is 1 m. square inside the collar and about 17 m. deep. The sets are framed of 4x6-in. pine. The first frame is laid on the ground and excavation commenced inside it. As the pit deepens, spiles of 4-in. diameter are driven outside it. When the tops of the spiles are about ½ m. above the collar piece, a new frame is driven in place at the bottom of the pit and, as the pit is further deepened, a new set of spiles is started. A block and tackle is the hoisting plant needed. Each tenth bucket load is thrown on the sampling plat for quartering.



TEST PIT FOR DUMP SAMPLING

A Guard for Mine Saws

A saw is an awkward thing to send into a mine and unless it be carried down by a man, which is bad practice, it is liable to be considerably dulled.

A good way to prevent this dulling is to fasten a flexible strip of wood with a small slit sawed in it, over the teeth of the saw. This protecting strip can be held in place by bolts passing upward at the side and over the back of the saw, arranged with a nut which can be tightened so as to hold the wooden strip in place on the teeth. If the timbermen can be persuaded to keep this strip on the saw when it is not in use, it will require sharpening less often.

*Mining engineer, Houghton, Mich.

Taxing Minnesota Mines

DULUTH CORRESPONDENCE

The Minnesota Tax Commission has just presented to the auditors of St. Louis, Itasca, Lake and Crow Wing counties, covering the Minnesota iron districts, detailed figures of the changes in iron-mine valuations in those counties, for the coming year. The total mine-tax assessment for 1910 was on a valuation of $220,432,000, based on 1,347,600,000 tons of iron ore, which were then shown to exist upon lands in these counties. For the next year the commission would, of course, deduct what ore had been mined from operating properties, thus diminishing the total, and add what new ore had been found, thus increasing it proportionately; providing there was no change in the basis of valuation, which in 1910 was from 35c. per ton for ore shown to exist on the highest grade of properties, such as the Hull-Rust and Mahoning, to 8c. for reserves of a not especially desirable character.

Carrying out this plan there has been a decrease of about $7,000,000 in the valuation of various mines in St. Louis and Itasca counties, from the figures of 1910, but there have been increases on other properties amounting to about $19,000,000, of which $16,160,000 are in St. Louis county, so that the total mine-tax assessment for the year 1911 amounts to $232,500,000 in round figures. St. Louis county shows a gross increase of $15,000,000. This, should it mean that the valuation tax is increased by new tonnage alone, would indicate about 80,000,000 tons of newly discovered ore in that country, estimating at 17c. per ton, the average of assessed value of ores for the year 1910. No such quantity of ore, however, has been discovered during the year; the commission has, on the other hand, assessed reserves at a much higher figure than before, either increasing the valuation per ton or arbitrarily adding to the tonnage that it estimated therein a year ago.

It has also, evidently, raised the valuation of properties that have passed from the reserve to the active list and those that have developed a portion of their known orebodies which a year ago were not uncovered. For instance, three reserves of ore held by the Oliver Iron Mining Company, in Itasca county, have been increased a total of $280,000; the Burt reserve in T. 58—R. 20, next the Clark mine, has been increased $875,000; another Burt reserve, in the same township, is raised $335,000; a Higgins reserve (Oliver company) in S. 9—T. 58—R. 16 is increased $620,000. The Hull-Rust mine is raised about $3,700,000, on account of additional development only; Scranton, $660,000; Bangor, $100,000; Alpena, $1,204,000; Hudson, $156,000; Harold, a Great Northern property under the Steel Corporation lease, $534,000; Stevenson, $173,000; Hill, a Great Northern leasehold, $350,000; Walker, also in part a Great Northern leasehold, $350,000. These higher values are all on development improvements. There is but one increase on the Vermilion range, that being the Chandler, which was abandoned by its former operators and was taken by others who have developed some ore; it has been raised consequently from $1050 to $12,750. There are no increases in the towns of Ely, Soudan, Biwabik, McKinley or Mountain Iron, and there are net decreases in 10 divisions and net increases in 12, with the greatest of the latter in the Hibbing district, amounting to $6,350,000, with Buhl next, at $1,221,000.

Although the State tax commission vouchsafes to the local tax boards no figures of tonnages nor rate of valuation per ton, it is quite evident that there has been little, if any, change in the per ton value from last year, when it ranged from 35c. downward. This is interesting in comparison with the facts regarding the recent drastic changes in valuations in the Michigan districts, where the tax commission has raised values for tax purposes from about $19,000,000 to $85,000,000, and where the ore in the ground is actually assessed at a valuation of 72c. per ton, for the known ore, and about half of that for the known and the probable ore combined, the figures for both known and probable being those furnished the commission by the Finlay report. A valuation of 72c. per ton on ore that has shown during the mining industry's most successful recent period an average profit of but 86c. per ton, is certainly "going some."

Water Power in Canada

SPECIAL CORRESPONDENCE

A survey of all the water powers in Canada is being made by the Commission on Conservation and a report is soon to be issued which will cover the water-power resources of every province. The engineers have finished their work in the Maritime Provinces and Quebec and are now engaged in the West in bringing up to date the data on the water powers there. The figures of the Hydroelectric Commission are to be taken for Ontario. The water powers of northern Ontario offer an immense field for development, and it is anticipated that before many years the eastern section of the Transcontinental Railway may be operated by power derived from that part of the province. They also play a large part in the mining enterprises and are largely responsible for the rapid development of Porcupine and Cobalt. The accompanying tables show the development to date.

WATER-POWER DEVELOPMENT IN CANADA

Province	Investment	H.P.
Ontario	$84,265,100	801,536
Quebec	70,872,200	563,156
Saskatchewan	.....	385,000
British Columbia	18,393,000	134,315
Alberta	9,425,000	81,700
Manitoba	14,470,000	58,000
New Brunswick	836,000	36,792
Nova Scotia	370,500	2,137
Prince Edward Island	10,000	44
Total		2,062,680

Santa Gertrudis Report

The report of the Santa Gertrudis Company, Ltd., recently issued, covers a period from Dec. 31, 1909, to June 30, 1911. The nominal capital of the company was, in January, 1911, increased to £1,500,000, of which 1,368,000 shares of £1 each have been issued. Of this new issue of 225,000 shares, Camp Bird, Ltd., has subscribed and paid for 93,000 shares to provide for the further cash requirements of the company. In consideration thereof, Camp Bird, Ltd., has the right to call at par, at any time up to 12 months from the date when the new mill of the milling company was effectively started, the whole or any part of the balance of the 132,000 unissued shares of the company.

TWO COMPANIES FORMED

In order to simplify matters connected with the working of the mines and mills in the Pachuca district, under the existing contracts, two companies were formed in Mexico: The Compañia de Santa Gertrudis, S. A., to operate the mines; the Compañia Beneficiadora de Pachuca, S. A., to operate the mill. The mining company was formed with a capital of 250,000 pesos.

When the property was taken over the large tonnage of ore, while accessible for inspection, was not opened for production. Neither was the mine equipped on the surface or underground for handling large tonnage nor was there sufficient shaft capacity. Furthermore, the development was inadequate for even the modest requirements of a 5000-ton monthly production then being made. Electric-power service was also insufficient. During the period the production of ore was accomplished under abnormal conditions, resulting in high costs, says Consulting Engineer Cox, that in no way reflect the costs of future operations when the mine is open for economical extraction. The original estimates going with the equipment of the mine and the capacity of the new mill have been materially modified, resulting in more outlay and longer time to complete.

POWER SERVICE INADEQUATE

Regarding the mine, it was learned after several months' trial that until greatly improved power service could be obtained, it would be impracticable to sink the San Francisco shaft against the flow of water. At the San Guillermo shaft a 300-h.p. electric hoist was installed, to-

gether with a large steel headframe and a 500-ton reinforced-concrete ore pocket. The shaft was put in excellent condition from top to bottom. It is equipped with a 5-ton skip operating in overbalance and has a capacity of at least 1000 tons per day. At the San Francisco shaft a 300-h.p. electric hoist was substituted for the steam plant and an air-compressor plant of 7000 cu.ft. per min. capacity was erected to supply both mine and mill.

Two completely equipped shops for framing timbers were erected, one at the San Francisco and the other at the San Juan shaft. Three electric-driven turbines and a number of compressed-air sinking pumps and four 52-h.p. electric-driven hoists were added to the underground mine plant. Machine, blacksmith, carpenter and electrical shops were built and fully equipped; these shops being provided with tools for turning out new as well as repair work.

To connect the San Guillermo ore pocket with the new mill, a tunnel was driven and a conveying-belt system installed, having a total length of about 725 ft. The ore is thus carried to the new mill at a nominal cost of about 3c. per ton, as against 45c. formerly paid the Pachuca Railroad Company for transportation to the Guadalupe plant.

Ore Reserves

The ore reserves are estimated as follows: 630,000 tons of positive and partly developed ore; 520,000 tons of probable ore; total value, $8,175,000. A 15-year contract has been executed with the Mexican Light and Power Company on favorable terms. The excessive cost of timbering or masonry required to keep levels open has prompted the method of extracting ore through a counter-drive on the foot wall that can be maintained at small expense after the level is wrecked by stoping operations. This method is in in use on the eighteenth level. During the period a total of 11,432 ft. of development work was done.

The earnings of the mine were £287,490, the operating expenses (exclusive of deferred development charges amounting to £31,967) were £349,505, and the net debit from operation £62,014. The net loss was reduced to £57,562 by miscellaneous revenue.

Milling Capacity Increased

The milling company was formed with a capital of 500,000 pesos. A contract having been entered into with the mining company to mill all its ores, it was decided to erect a much larger and more economical plant adjacent to the mine. This new mill, commenced and practically completed during the period, called for an expenditure for construction of £36,138, and started operations on June 14, 1911. The plant was designed to handle 600 metric tons per day and it is probable that with the exception of 10 Pachuca tanks, no further important equipment would be required for a capacity of 850 metric tons per day. During the few days' operation in June, before the close of the period, 5455 tons of ore were treated, containing £18,326, and the indicated recovery was 93 per cent., as against 87 per cent. in the Guadalupe plant.

Besides complete crushing and sampling plants, the new mill consists of sixty 1550-lb. stamps, 10 tube mills, 18 Pachuca agitation tanks, four 90-frame Merrill slime filter presses and six 34-frame Merrill zinc-dust precipitation presses, together with a complete equipment of auxiliary apparatus, such as Dorr classifiers, Dorr thickeners, pumps, tanks, melting furnaces, etc. Steel and concrete construction has been used practically throughout.

New Mill Now Operating

The ores from the mine are now being diverted to the new mill, and the Guadalupe plant is operating on tailing residue from the old patio process. The period of construction being practically over and the development of the mine well under way, efforts will be directed to the economies of operation. The profit from the milling operations is reported as £100,000, together with £16,000 recovered from the quicksilver in the old patio.

The class of labor available in the Pachuca district is wholly inefficient and extremely irregular in its habit of work. It is proposed by the management to attempt an improvement of this labor to effect which will require not only the care and skill now exercised by the mine officials, but also the establishment of a well housed laboring community adjacent to the property controlled by the company. The initial expenditure for these houses would be approximately $15,000, from which a fair revenue could be derived in rentals.

Assay of Platinum

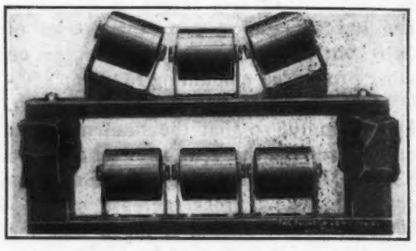
To avoid the inaccuracy due to the use of boiling concentrated sulphuric acid in parting the platinum-silver button in the assay of platinum, A. Steinmann proposes the following method:

About 250 mg. of the platinum alloy are mixed with silver (at least five times the quantity of platinum present), copper (a quantity equal to that of the platinum) and lead, cupelled at a comparatively high temperature, and the residue fused for from 3 to 5 min. The resulting button is rolled to a thickness of 0.2 mm., and heated for 15 min. with diluted sulphuric acid (100 volumes of concentrated acid to 22 volumes of water) at a temperature not exceeding 240 deg. C. The treatment with acid is repeated twice, and the residual platinum is washed, dried and weighed.

The Unit System for Conveyer Idlers

The rolls or idlers for a conveyer belt, shown in the accompanying illustration, have been recently put on the market by the Stephens-Adamson Manufacturing Company, of Aurora, Ill. This unit-carrier system consists of single rolls mounted on individual steel stands. Various combinations of these units are assembled to make different widths and styles of carriers as required. The complete separation of the units permits of every possible arrangements of the rolls to suit all conditions. The support used for the roll consists of a steel-plate bracket which carries, in ball bearings, the short shaft on which is mounted the cast-iron pulley. The complete carrier is assembled by mounting the units on a wooden plank or steel channel in any desired arrangement.

It is claimed for this type of carrier that additional units of any width may be easily adapted to a conveyer of a larger size, and thus a required increase in capacity will not necessitate discarding the old carrier. This feature is important, as few plants or mills are built today without provisions being made for future increase in capacity. The great flexibility allowed by the unit system permits exact adjustment of the carrier to any desired condition. This is particularly noted in the possible variation from a flat carrier to one with troughing rolls inclined at any angle. The feature of individual support for each roll allows the carrier to adjust itself to any settling of the supporting framework.



Unit System of Conveyer Carriers

The same units may even be used as guide rolls, although special guide rolls of smaller diameter, which are manufactured to fit the standard bracket, are less expensive for this purpose. All parts entering into the construction of the carrier, are made in uniform shape and size, repairs may thus be made with the positive assurance that they will fit. As the brackets are made of heavy steel plates, the carriers are practically indestructible. The short shafts with two supports for each roll provide great strength.

The shafts of the rolls are supported in ball bearings, which absorb the minimum amount of power. These are placed in dust-proof grease pockets which contain a supply sufficient to lubricate the

bearings for several months. Actual running tests for a period of over two months, under the severest possible conditions, are claimed to have shown no diminution of the supply of grease in the pockets. Indications are that in ordinary service, the grease will not have to be renewed oftener than every six months or a year. The bearing is also absolutely tight, and there is no possibility of grease coming in contact with the belt.

Porcupine Gold Mines Company

In a report of the general manager of the Porcupine Gold Mines Company, dated Nov. 6, 1911, the result of 18 months' development work on its holdings in the Porcupine district of Ontario is given. The holdings of the company consist of 440 acres, of which 360 acres are in Tisdale township and 80 acres in Mountjoy township.

Development

The surface was partially prospected by approximately 10,000 ft. of trenching and stripping; 23 veins were discovered, but underground development was confined to veins Nos. 2 and 3. On the surface No. 2 vein was stripped and trenched for a distance of 600 ft. The course of the vein is north 15 deg. east, and the dip is 80 deg. to the south. The vein shows a width of from 2 to 8 ft. and is composed of quartz, mineralized schist and ferrodolomite.

A vertical shaft 4½x8½ ft. in the clear was sunk to a depth of 232 ft. in the hanging wall of this vein, and stations were cut at the 100- and 200-ft. points. From the station of the 100-ft. level a crosscut was run, which intersected the vein at a distance of 45 ft. from the shaft. Drifts were run on the vein 78 ft. to the northeast and 245 ft. to the southwest, a total of 323 ft. The vein shows an average width of 18 in. of quartz and from 3 to 6 ft. of mineralized schist and ferrodolomite. From this drift two crosscuts were run to the south. No. 1 crosscut starts at a point 65 ft. east of the shaft and cuts through 52 ft. of quartz and schist. No. 2 crosscut, 130 ft. in length, intersects the No. 3 vein. Crosscuts from the No. 2 station are now being run to intersect both Nos. 2 and 3 veins.

No. 3 vein was exposed for a distance of 430 ft. by stripping and cross trenching. An incline shaft has been sunk in the hanging wall to a depth of 56 ft. Owing to difficulty in keeping the shaft free from water, the work was stopped at that point. No. 2 crosscut on the 100-ft. level intersected this vein at a point 80 ft. below the surface and showed a mineralized zone of quartz and schist. This orebody was penetrated for a distance of 25 ft. and the south wall was not reached. Shallow pits and cuts were made on the other vein exposed and the extensions of several of these veins have been extensively developed in the Crown Chartered and Success mines on the east.

On the completion of the new compressor plant the main shaft will be continued down to the 500-ft. level; drifts on the present levels will be continued to the limits of the oreshoots; prospect crosscuts will be run at various points where there are indications of parallel orebodies and raises made to connect up the different levels and the surface.

Results of Sampling

The outcrop of Nos. 2 and 3 veins were sampled in June, 1910. Sampling was confined largely to the quartz, the schist and ferrodolomite not being included. Groove samples, averaging 15 lb. to the foot sampled, were cut at intervals of 5 ft. on all quartz outcrops. No. 2 vein, the report states, showed an average value of $52 for an average width of 23 in. over a length of 400 ft. On the 100-ft. level samples were taken at intervals of 5 ft. across an average width of 42 in. Both schist and ferrodolomite were included in these samples. An average of $23.10 was shown for the above width over a length of 210 ft. The limits of the orebody were not determined.

Sampling along the outcrop of No. 3 vein showed two shoots of ore, 90 and 60 ft. in length. The quartz for an average width of 12 in. is reported to average $83.45 per ton. The total width of the vein was not determined on the surface, the trenching having been confined to one high-grade streak in the vein. At two points where the walls of the trench were shot out, the vein ran from $8 to $37 for a width of 8 ft. The crosscut from the No. 2 vein on the 100-ft. level shows 30 ft. of vein matter, 15 ft. of which is stated to run $11.20 per ton. One section, 12 in. in width, showing considerable free gold, gave returns of $176 per ton. This crosscut intersects the vein at a point 47 ft. east of the surface exposure.

The following estimate of costs is given: Sinking the main shaft, $27.50 per ft.; driving and crosscutting, $9 per ft.; these costs include all overhead charges, such as superintendence, office, etc. On a 100-ton basis, development is estimated at $2.80 per ton; mining, $1.75; milling and cyaniding, $1.35; a total of approximately $6 per ton.

A 10-drill compressor, electric driven, and a 40-h.p. hoist are now being installed at the main shaft to replace the prospecting plant. A mill of 100 tons daily capacity has been ordered and grading for the site is under way. A suitable assay office and sample-crushing plant is being erected. Arrangements have been made for the use of electric power, generated by the Porcupine Power Company, and a pole line completed to the property.

Katanga Copper

The Tanganyika Company, which was going to flood the market with copper in 1911 (date now advanced to 1912, or later), does not appear to be having clear sailing. A London contemporary states that this company has entered into guarantees of railway and other debentures that now call for £222,315 per annum. It was hoped to meet the increasing obligations out of profits on the copper, but the latter have not yet figured prominently in the accounts of the company, and it is rumored that some more financing must be done. Meantime, the shares of the company have been slumping, which seems only natural.

In a letter of Oct. 30, addressed to the directors of the Tanganyika Concessions, Robert Williams, managing director, explains the position as follows: "Up to date our smelting in Katanga has been interrupted by the usual causes that obtain when starting new works in a wild country. These, however, are being met by appropriate remedies. Since Sept. 16, the furnace has been running without a stop, producing about 12 tons of copper per day; 764 tons of copper ingots have been produced altogether, from the commencement of smelting, part of which has already arrived in Antwerp. Our resident metallurgist in Katanga reported under date of Oct. 4 as follows: 'The furnace at the Lubumbashi is now running excellently, using only the green aluminous ore and the new laminated and more silicious ore. During the first three days in October there were smelted 336 dry tons of the mixed ores, averaging 12.5 per cent. copper, and 37.5 tons of copper bars were obtained (95 per cent. Cu.) = 36.6 tons copper, being a recovery of 87 per cent. of the total copper in the ore; 10½ per cent. of the total copper was lost in the slag, and 2½ per cent. in flue dust. An average of 180 tons of charge was smelted per day, and yesterday we attained the maximum that has yet been smelted—i.e., 201 tons of charge.' My representative states that the furnace is undermanned, and asks for more experienced men, and further states that he believes that he will be able to cut down the coke consumption and to reduce the cost of fuel."

The Electra Oilfield of Texas

The Electra oilfield, in Wichita county, Texas, is now the largest producer in that State, with the Humble field, north of Houston, second. According to William B. Phillips, director of the Bureau of Economic Geology of Texas, there were, in October, 28 producing wells, with a total average monthly production of 8300 bbl., the producing companies being the Producers' Oil Company (3300 bbl); Corsicana Petroleum Company (2500 bbl.); and Red River Oil Company (2500 barrels).

A System of Keeping Stoping Costs

By Claude T. Rice

At the mines of the Goldfield Consolidated Company costs are kept for each stope. This provides an accurate and ready means of controlling profits. Stoping is discontinued if unprofitable for five days.

Much of the profit that has been made from the Goldfield Consolidated mines is due to the fact that each stope is worked as a unit and all costs are kept in such a manner that at the end of the shift they can be segregated and apportioned to each of the stopes.

The grade of ore coming from each working face is determined and by keeping costs for individual stopes each is operated at a profit. In case that it cannot be profitably operated for a period of five days, it is put on development. In general the ore at the Consolidated mines must assay $6 per ton to be profitable, but this varies both with the cost of mining in the particular working and the composition of the ore, especially in regard to the amount of cyanide consumed in its treatment.

Loose-leaf Forms

In order to facilitate the keeping of these individual costs, blank forms are used that can easily be inserted in loose-leaf books. As it may aid others in devising a similar system some of the forms that Heath Steele introduced at Goldfield are reproduced herewith. In some respects changes may have to be made to conform to the necessities of each case, but in general they will be found of wide application and can be used as a basis upon which to build.

Each man is provided with a brass check before entering the mine. This check he leaves in the change room before going off shift. The number corresponds with the number of the employee on the pay roll, serving in this way to identify him in case of accident while in the mine.

Time Record Kept by Bosses

The distribution of costs to individual working faces begins with the distribution of the labor costs from the shift boss' timebook, a specimen page of which is shown in Fig. 1. This loose leaf is, in the original, 6x10½ in., and ruled for 31 days. One sheet is used for each employee. The loose-leaf form permits changing from one boss' binder to that of another, as the employee is shifted. Space is provided for a record of the boss upon whose shift the man is working.

At the end of the shift the boss enters the time on this form; general work, such as hoisting, requires nothing but the checking of time. The credits are checked against the brass checks deposited in the change room. From this timebook, the entries on the general timebook and daily-payroll distribution book are made at the central office.

In Fig. 2 is shown the form of the shift boss' report, which in the original measures 13x11¾ in. with a margin for binding 1¾ in. wide at the top and one for remarks at bottom. It is ruled horizontally for the record of 31 working places, which is large enough to allow the records of all the workings in one of the Goldfield Consolidated mines for one shift to be kept on one sheet.

At the end of a shift the boss records on this report from his personal inspection, the number and type of drills, for each working. The labor figures he gets from his timebook and the timber used in each working place from the head timberman, who gets his items from the different men working for him. The cars of ore and waste from each working, the boss obtains from the tags that the topman has gathered during the shift, for when a carman loads a car at a chute or trams one from a drift, he puts a tag in it which, by its shape, shows the nature of the contents, while on it is the number of the working where it was loaded. The explosives that are used in each working, the boss obtains from the powder boy (also the tool nipper) who, when he goes through in the morning, gets from each miner the amount of dynamite and number of fuses he will need that shift and later sends them down. On filling these orders he records on a slip the amount of dynamite and number of caps going to each working place.

Stope Sheet Kept by Timekeeper

This report all filled out, the shift boss turns in to the timekeeper who enters the data on the loose-leaf form shown in Fig. 3, which in the original measures 16½x17½ in. with a margin one inch wide at the top for binding and another two inches wide at the bottom for remarks; horizontally the report is ruled for 31 days. The timekeeper gets the assay of the ore from the assay reports. The other data come from the report of the shift boss. Later, the timekeeper calculates the costs of the different items, having a certain fixed charge to make for air, lubrication and repairs for piston machines, and another for air-hammer drills, this having been carefully determined from the costs in previous months. The timber and explosives he figures from their actual cost delivered at the mine, while the general charges, which include all accounts that cannot be distributed direct up to and including mint charges, are constant, or are varied from time to time if necessary. The cost of the different workings he reports at frequent intervals to the mine superintendent and

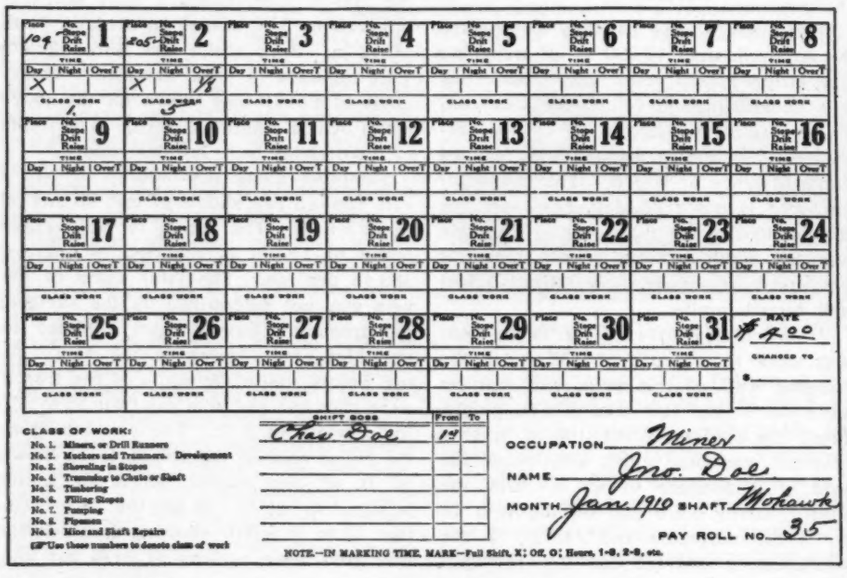

CLASS OF WORK:
No. 1. Miners, or Drill Runners
No. 2. Muckers and Trammers. Development
No. 3. Shoveling in Stopes
No. 4. Trimming to Chute or Shaft
No. 5. Timbering
No. 6. Filling Stopes
No. 7. Pumping
No. 8. Pipework
No. 9. Mine and Shaft Repairs
SHIFT BOSS
Chas Doe
From 1?
To
OCCUPATION Miner
NAME Jno. Doe
MONTH Jan 1910 SHAFT Mohawk
PAY ROLL NO. 35
NOTE.—IN MARKING TIME, MARK—Full Shift, X; Off, O; Hours, 1-8, 2-8, etc.

Fig. 1. Individual Time Sheet

to the manager, so that any striking anomalies in cost soon come to the attention of those officials.

Record of Costs Kept for Each Mine

In Fig. 4, which in the original is 13x24 in., with a margin 2¾ in. wide on the side for binding, is shown the form on which the total operating costs for each month are kept for each mine. This is the form in which the costs are preserved at the general office and is the record of past operations to which the general manager refers in making comparisons of costs unless he wants information in greater detail. Horizontally are recorded the items of the different segregated accounts, while below the regular items is left space for nine others in case expenses should arise which are not covered in those above.

Direct development is itemized as to miners, muckers, trammers and timbering. Direct stoping is subdivided into miners, shovelers, trammers, timbering and filling. General accounts are itemized as hoisting, general blacksmith, pumping, air drills, explosives, sampling and assaying, watchmen, mine office and change room, superintendents, foreman and shift bosses, repairs and renewals to buildings, repairs to machinery, general surface, construction, lighting, miscellaneous iron and steel, tools, miscellaneous supplies, miscellaneous repairs, heating, surveying, mine and shaft repairs.

Below, these different items are totaled while in the lower margin of the forms a résumé of the mine work is made. First are the production figures from development and from stoping and both as to ore and waste, with the tonnage of the two as total waste and total ore, as well as total tons from each kind of working. Below that in horizontal line are recorded feet advanced and cost per foot, cost per ton of ore from stopes, cost of development per ton of ore produced, cost of stoping per ton of ore produced and total mine-operating costs per ton of ore.

In another column farther to the right on this lower margin are given the items for the financial statement of the mines. These consist at the top of the tons produced, extraction, gross value and average value of both these items for total production. The costs are given as to total and average for the following items: General expense, stoping, development, transportation, milling and concentrates treatment; total of these less miscellaneous earnings; total cost, profits. In the remarks column, space is left for the statement of machine-shift costs.

System Is Simple in Operation

This system, while it may at first inspection seem cumbersome, has been found convenient and by the control it affords much expense has been saved by each shift. Most of the work entailed by this system of individual costs is arranged so that it comes on men who are not too busy with that kind of work, and so the preparation of the reports does not become irksome. Moreover, on account of the systematic manner in which the different items for the individual cost sheets are gathered, the work is greatly diminished.

Such a cost system is absolutely necessary to get the maximum profit from any mine, but especially to mines like those at Goldfield where conditions and the value of the ore vary greatly in different parts of the mines. Probably few managers realize how much money is lost through the mining of ore just too low in grade to be profitable. A stope may furnish ore that is just above the grade that would be profitable at the average cost of mining for the whole property and yet on account of its composition or anomalies in its mining, a considerable loss may result from the working of this part of the mine. In short, the richest stopes are too often made to carry the poorer. With the individual-stope system of cost keeping, all such ore would be left behind unless it was mined in development work in the hopes of finding richer ore.

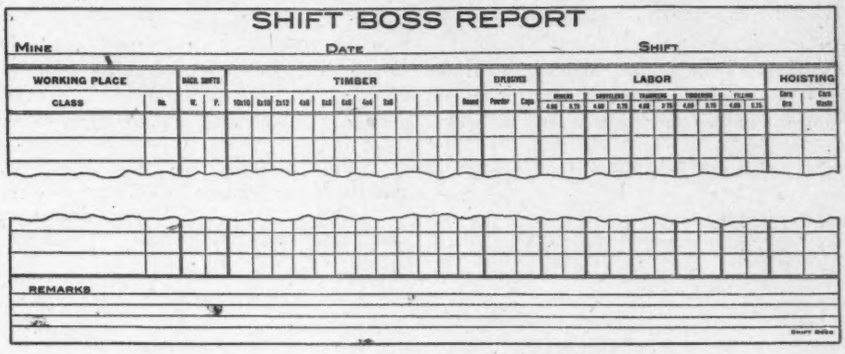


Fig. 2. Specimen of Shift Boss' Report Form

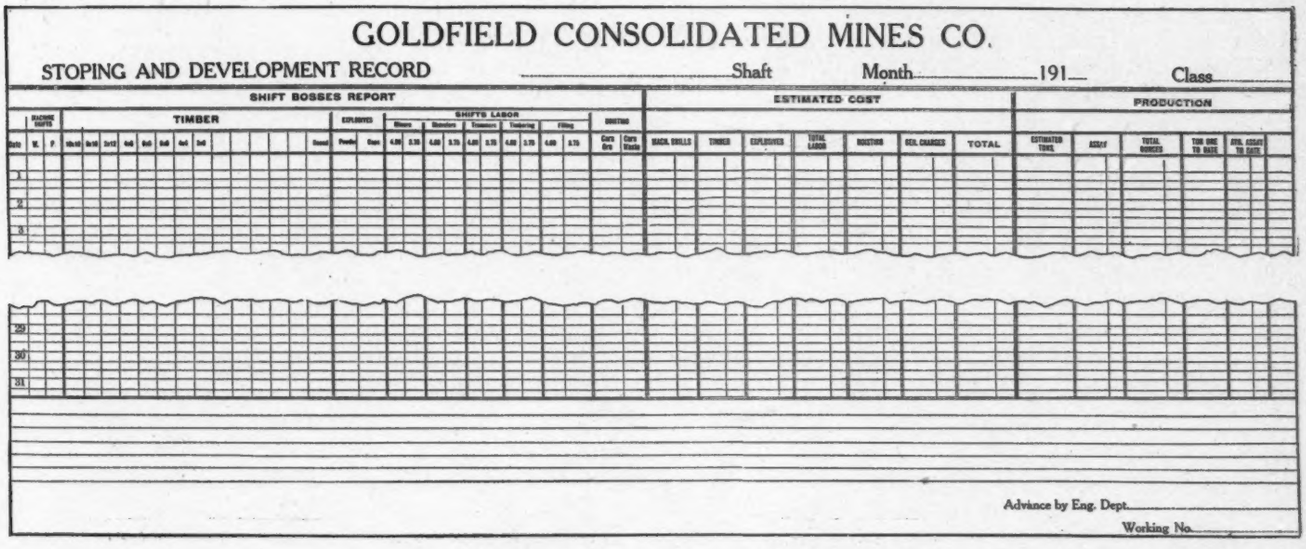


Fig. 3. Monthly Cost Sheet for Individual Stope

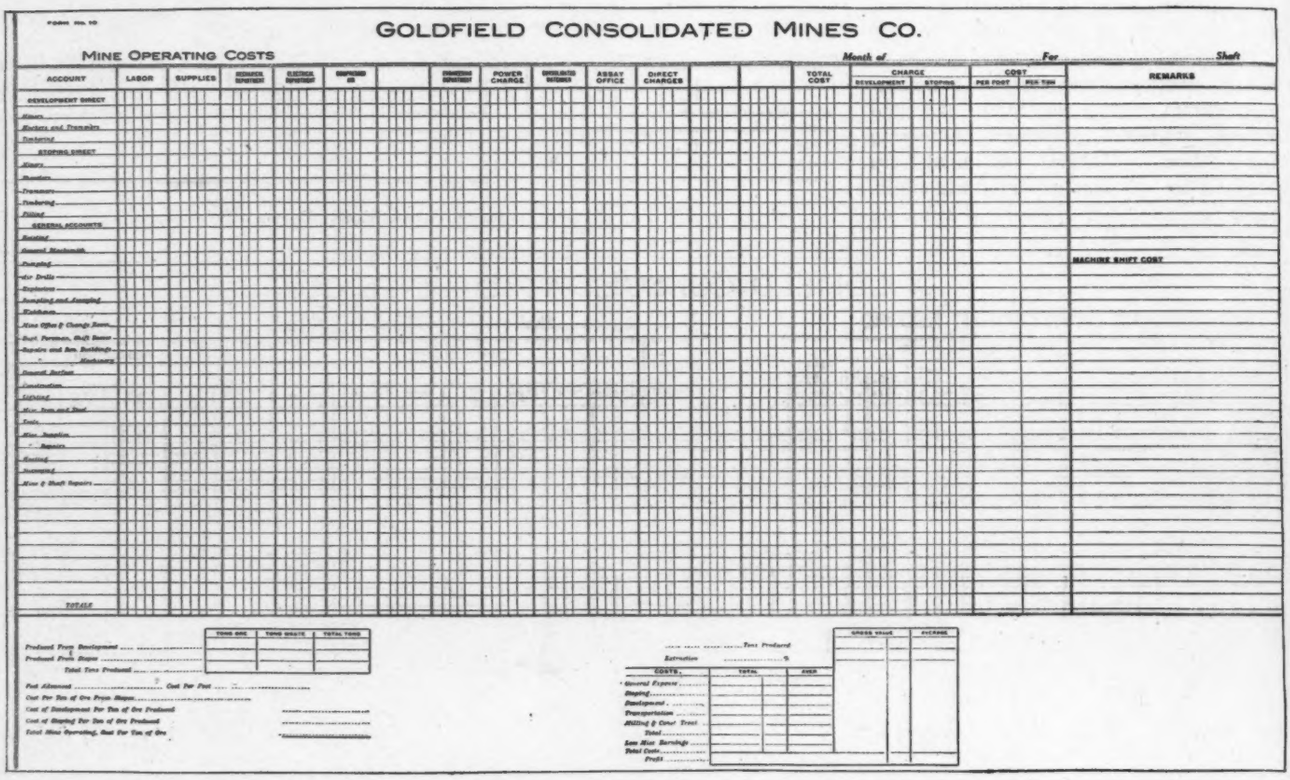
Of course in making close decisions where the amount of ore coming from the workings in question is small compared to the total tonnage mined, only the direct costs for stoping and for treatment should be charged against the stope as the mine would have to carry the general costs, taxes, etc., whether the ore in question was mined or not. Moreover, when the stoping is to be continued as development work, the mining costs should be remitted and only the treatment costs entered against the ore in determining whether the product of the stope is to be considered waste or ore.

In this system, the composition of the ore is taken into account. This is an important point that is often overlooked at the mines where the ore must receive chemical treatment either in a mill or at a smeltery. At the Copper Queen mines at Bisbee, Ariz., a system of individual-stope cost keeping is used. There, the system takes into consideration the effect of the composition of the ore on the treatment charge that the smeltery will make against the mine.

Report of Natomas Consolidated

The Natomas Consolidated, of California, has issued an interim report by Charles M. Rolker on the operations since the incorporation of the company in November, 1908, to July 1, 1911. Mr. Rolker estimated that at Jan. 1, 1909, the tested dredging lands of the company contained a grand total of 324,995,536 cu.yd. of auriferous gravel with an average value of 9.9395c. per yard, which would produce an average net profit of 5.8506c. per yard, or a total of $20,067,195, from the tested lands, besides which the untested lands were estimated to yield a profit of $3,240,000, making $23,307,195 net dredging profits on the area with which the company started in 1909. The results up to June 30, 1911, show 44,542,141 cu.yd. dredged for a total gross value of $4,377,000, or a gross value of 9.8260c. per yard, and a net profit of 5.6920c. per yard. The net profit is rather below Mr. Rolker's estimate, but the costs were higher than the estimated costs for the earlier part, and, furthermore, individual trial periods offer no conclusive comparison with the final total estimated costs. The life of the tested gravel lands was estimated at 10.5 years from July, 1911, but other adjoining lands have been purchased, so that the total life of the dredging ground now owned by Natomas will far outlast the above period.

Besides the dredging ground, the Natomas company has other valuable assets in: (1) Water rights, which are expected to prove a source of income after supplying the company's requirements. (2) Vineyard and orchard department—the company has 565 acres under wine grapes, and pursues the policy of leasing the vineyards for a term of years. (3) Rock-crushing business—the company crushes the boulders raised by the dredges into road material, and the profit from this source in 1910 was estimated at $106,073. Besides these resources there are the lands to be made valuable by irrigation, and those to be reclaimed by protecting them from flooding. The total value of these resources is estimated at $35,111,516. The first-mortgage bonds, of which $15,000,000 have been authorized and $11,200,000 issued, are therefore well covered by these assets. For the six months up to July 1, 1911, the surplus was $230,140 over all bond interest and fixed charges.


GOLDFIELD CONSOLIDATED MINES CO.

MINE OPERATING COSTS

Month of ..... For ..... Shaft

ACCOUNT	LABOR	SUPPLIES						POWER CHARGE		ASSAY OFFICE	DIRECT CHARGES			TOTAL COST	CHARGE		COST		REMARKS
															DEVELOPMENT	STOPING	PER FOOT	PER TON	
DEVELOPMENT DIRECT																			
Miners																			
Muckers and Trammers																			
Timbering																			
STOPING DIRECT																			
Miners																			
Muckers																			
Trammers																			
Timbering																			
Filling																			
GENERAL ACCOUNTS																			
Bonding																			
General Blacksmith																			
Pumping																			MACHINE SHIFT COST
Air Drills																			
Explosives																			
Sampling and Assaying																			
Watchmen																			
Mine Office & Change Room																			
Asst. Foremen, Shift Bosses																			
Repairs and Ren. Buildings																			
" Machinery																			
General Surface																			
Construction																			
Lighting																			
Mine Iron and Steel																			
Tools																			
Mine Supplies																			
" Repairs																			
Hoisting																			
Pumping																			
Mine & Shaft Repairs																			
TOTALS																			

	TONS ORE	TONS WASTE	TOTAL TONS
Produced From Development			
Produced From Stope			
Total Tons Produced			

Pct. Allowed ..... Cost Per Ton .....
Cost Per Ton of Ore From Stope .....
Cost of Development Per Ton of Ore Produced .....
Cost of Stoping Per Ton of Ore Produced .....
Total Mine Operating, Cost Per Ton of Ore .....

..... Tons Produced
Extraction ..... %

COSTS	TOTAL	AVER
General Expense		
Stoping		
Development		
Transportation		
Milling & Conc. Treat.		
Total		
Less Mine Earnings		
Total Costs		
Profit		

GROSS VALUE	EXCESS

FIG. 4. MONTHLY COST SHEET FOR ENTIRE MINE

There were five silver-lead smelting works operating in Belgium in 1910, employing 1818 workers. According to *Annales des Mines de Belgique*, these works treated 48,025 tons of foreign ore, 84,975 tons of argentiferous and auriferous lead byproducts, and 48,595 tons of work lead.

U. S. Salt Production

The United States produced 30,305,656 bbl. of salt in 1910, valued at $7,900,344, according to figures compiled by W. C. Phalen, of the U. S. Geological Survey. This was an increase of 198,010 bbl. over the production of 1909, but a decrease of $443,487 in value. The six leading producers of salt in 1910 were New York, Michigan, Ohio, Kansas, Louisiana and California.

Alluvial Gold Deposits in Quebec

By Fritz Cirkel*

Presence of gold in Beauce county known since 1835. Mining has been spasmodic and methods primitive. Thorough testing is being done to determine average gold content and method of recovery.

*Consulting mining engineer, 80 Stanley street, Montreal, Canada.

Lieutenant Baddeley, of the Royal Engineers, whose great interest in the occurrence of Canadian minerals is well known through his many official publications, reported in the year 1835 that alluvial gold had been found in Quebec on the Chaudière river, county of Beauce. The discovery, consisting of a gold nugget of 1066 grains, was made by a young woman on the Gilbert river, not far from its confluence with the Chaudière.

Mining Has Been Spasmodic

From that time up to the '80's the county of Beauce was the scene of intermittent activities in the search for the precious metal. Miners came and went and fortunes were made and lost; this lasted until the placers easiest of access were worked out and until it was found that the primitive mining methods then in vogue no longer admitted of working the ground at a profit. The members of the De Lery family, under the advice of Dr. James Douglas, first mined gold in 1846 on Lot 75 of the first range northeast of the Seigneury Rigaud de Vaudreuil.

Up to the year 1875, mining was carried on in a most spasmodic fashion; placers were repeatedly washed over and over again and abandoned and little effort was made to work those deposits which were difficult of access. The most flourishing period in the history was between 1875 and 1885, when an average of 500 miners were employed on the Gilbert river. In 1886 almost all mining in Beauce was discontinued and since that time little serious or systematic work has been undertaken. The country over which alluvial gold has been found to occur is tributary to the Chaudière river from the Des Plantes river upward as far as Trout river, covering an area 20 miles long by about 12 miles wide.

Recent Explorations

It is not the purpose of this article to go further into the history of gold mining in that district; those who take an interest therein may consult the Quebec government reports of 1898, where a full account is given of the spasmodic activities in the county of Beauce; but I have been identified with rather extensive exploration work for the last two years within the Seigneury Rigaud de Vaudreuil and wish to furnish a few notes regarding recent developments, in view of the fact that renewed interest is displayed in connection with the gold alluvions of that part of the country.

The topographical and physical features of the country under consideration seem to be to a large extent responsible for the distribution of the gold alluvions in almost all the places so far known, for everywhere deep river valleys are found cutting through a highly undulating plateau and it is principally along these narrow river valleys that the natural concentration process of the gold-bearing gravels has taken place. The principal river, the Chaudière, is fed within the limits of the gold alluvions by not less than 30 creeks and rivers and to my knowledge there is not one of these which, upon closer investigation, has not shown alluvial gold in more or less quantities.

Schists, Slates, Sandstones and Eruptives Are Found

Geologically, the country is composed of a series of Cambrian and Cambro-silurian schists, pure clay slates and quartzose slates, interstratified with sandstones, and cut occasionally by eruptives; their general strike is N. 64 min. E., with a steep dip to the west, but dips to the east have been observed in the vicinity of intrusives, as on Lac aux Raquettes. The schists and slates are highly fissured in the direction of the strike, giving the whole a highly laminated, tabular structure; they are mostly contorted and twisted in the vicinity of these intrusives, in which case they show an abundance of minute quartz stringers and veins. They are well developed all along the Chaudière river from St. Joseph as far as the Famine river. The intrusives consist for the most part of granites, diorites, gabbros, serpentine and diabase porphyry.

On the Des Plantes river below the falls, these intrusives are composed of a succession of granites, serpentine and diorites. Above the village of Beauceville a series of dioritic bosses form the protuding rocks in Devils rapids. On the Gilbert river and in the country between Lake Fortin and Lake Castor, and also near Lake aux Raquettes, prominent hill features are caused through diorite diabase, while serpentine forms the principal intrusive rock on the lower Le Bras river. A diabase porphyry was found in one place, namely, on Callway creek, where numerous quartz veins intersect

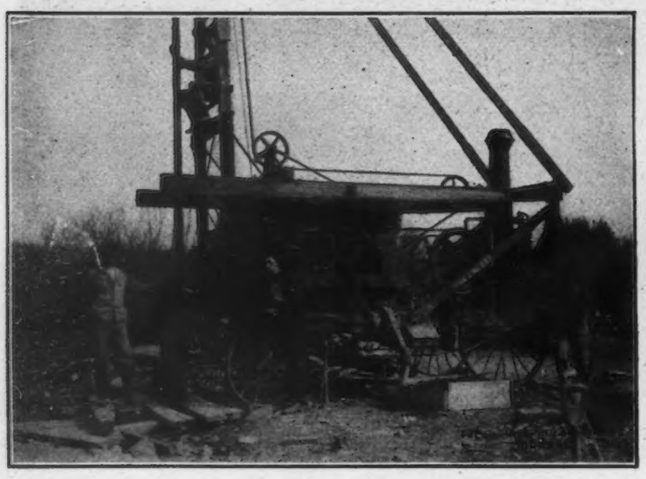
Alluvial Ground on the Gilbert River

the intrusive masses in every direction. All these intrusions belong to the extensive mineral-bearing belt which, from the Vermont boundary near Lake Memphremagog, strikes northeastward for 120 miles, crossing the Chaudière river between Callway creek, five miles below Beauceville, and the big falls on the Chaudière, six miles above St. Georges.

Outcrops of Lode Quartz

Many outcrops of lode quartz occur within the region, more frequently within the territory of the Seigneury Rigaud de Vaudreuil, the most conspicuous one being the Bilodeau vein on the Barbeau lot, near the Devils rapids. Mining of these quartz lodes was attempted in the '60's and '70's, and as far as I am aware, shafts were sunk in only three of them to a depth of 35 and 50 ft., but the results were not of such a nature as to encourage further development work. A stamp mill was built near the Devils rapids in the '60's for the purpose of treating ore from a number of lodes in the vicinity, but after a six months' trial run, operations were discontinued.

Mechanical Elevator and Auriferous Gravel Bank along Ruisseau des Meules



Exploring Quebec Alluvions with Keystone Drill and with Empire Hand Drill

de Vaudreuil, and while the investigations of all of these are by no means concluded, it may be affirmed that so far in almost all the veins little gold has been discovered. Most of these lodes form interbedded veins along the strike and dip of the country rock; they vary in width from 1 ft. to almost 20 ft., and are composed of a white vitreous quartz, sometimes heavily charged with mispickel and pyrites. Galena, blende and pyrrhotite are occasionally met with. Associated with the quartz are sometimes calcite, chlorite and gypsum. I have counted 27 quartz veins of more or less importance within the Seigneury Rigaud

It seems that most of the quartz veins are confined strictly to areas which have undergone little displacement or disturbance from intrusives. Only in four places were quartz veins found along contacts with intrusives; these assayed from $2 to $4 per ton, but their general habitus and characteristics were so abnormal that no miner of experience would attempt to work them. In view of the richness of some of the alluvial pay streaks found in the district, it is somewhat disappointing to learn that the quartz lodes so far opened do not contain gold in paying quantities, for the opinion is generally expressed that these gold alluvions are the result of successive disintegration of these quartz lodes. This question has occupied engineers and geologists now for over 50 years, and after careful analysis of all the facts presented, together with investigations of my own, covering a period of over two years, I have come to the following conclusions:

Old Theories Not Supported

Many investigators consider that the gold has been derived from masses of dioritic and basic rocks, or concentrated from that which has been disseminated through the mass of metamorphosed basic rocks, or in part contained in quartz veins. In fact, one investigator considers that the gold may have been derived from the country rock altogether. However, it seems that the evidence so far produced in support of these theories is so weak that it is well to look for another source of the gold supply.

One of the most popular arguments in the discussion of this theory is the supposed accumulation of gold at or near quartz veins or intrusives. In fact, one geologist establishes this as an important fact, when he says: "The richest pay

streaks in Quebec, or those yielding the largest nuggets and the coarsest gold, have been uniformly found overlying quartz veins or eruptives." Now, with the exception of only two, all the quartz lodes so far tested carry but traces of gold, while not even a trace was found in the eruptives nor in the altered slate highly charged with iron pyrites.

No Access to Earlier Diggings

It must be admitted that I have had no access to the earlier deep diggings in the district and for this reason I am not in a position to give my opinion as far as these older workings are concerned, but I have found no confirmation of the above statement during the course of recent investigations. In support of this, the following examples may be mentioned:

On the northeast branch of the Gilbert, a rich pay streak was established running approximately with the strike of the country rock. For a distance of 350 ft. the alluvions were crosscut immediately over the country rock, but neither quartz veins nor eruptives were found in the vicinity. The most striking example, however, is the Ruisseau des Meules diggings. Here the country rock has been laid bare through hydraulicking for about 1½ acres and no vestige of quartz or intrusives can be seen, though one of the richest pay streaks, carrying some of the largest nuggets, has been opened. If the gold does occur, as has been asserted, in the older diggings close to quartz veins and intrusives, then we may look for the source of this in some other direction. It is well known that these quartz veins and eruptives are much harder than the surrounding rock; they withstand erosion better and thus formed riffles, so to speak, for the concentration of the gold when it was carried down by the river.

Cleaned Bedrock, Des Meules Creek

Cleanup on Des Meules Creek

Gold Is Waterworn

Recent cleanups have facilitated the study of the nature of the alluvial gold and it seems that the gold, which is mostly coarse and nuggety, has a waterworn appearance, indicating that it has undergone considerable traveling before it reached the spot where it is found today.

I have closely examined the fine as well as the coarse gravels with which most of the nuggety gold is associated and found rock fragments which could not have found their source in local rocks. For instance, certain species of greenstone and a large amount of a purple soft slate and schist are found immediately over bedrock on the Des Meules diggings, but so far no rock of these descriptions has been found *in situ*, or, for that matter, in the seigneury. Some of the nuggets appear to be composed of smaller nuggets, great compression and rolling, due to intrusive movements in the gravel, having evidently facilitated interfolding and locking of gold particles; through the permanent contact with boulders, during the concentration process, the nuggets take an angular form and become more and more compact and homogeneous. On the Des Plantes river the gold is of a flaky form, indicating that it has been carried for long distances, because this form increases its suspensibility in water and lessens the natural concentration tendencies, due to its great specific gravity. It is true that some of the gold does not show an angular or flaky form, but exhibits a crystal-like or wiry form with velvety surfaces; it has not the regular exterior form of crystals but may be considered as intermediate between the amorphous state and true crystals. Quite a number of nuggets of this character have been found attached to quartz and it is possible that they have been carried in their original state and condition for long distances within quartz fragments and pebbles, and that these have been breaking up slowly after their deposition, liberating the gold within. Based upon the foregoing facts, it seems likely that the gold has been derived from a place outside of the region of the local gold alluvions, from sources as yet unknown.

Deposits are Pre-glacial and Post-glacial

The Beauce gold alluvions may be generally classified according to their time of deposition into the pre-glacial and post-glacial deposits. The pre-glacial alluvions are nearest to the bedrock; they form ancient river channels, and are covered with great thicknesses of gravel, sands and boulder clay. The post-glacial or younger gravels, found mostly above the boulder clay, may be considered as rearranged gold gravels of pre-glacial age, and are generally found at places where recent streams have cut through the old gravels and redeposited them along their downward course.

I have obtained, in the course of my work, a great many sections through the alluvions in drill holes and shafts at various places, and while the sections vary a great deal in different parts of the country, they almost invariably contain the following general succession of superficial deposits in ascending order: (1). Decomposed country rock; usually auriferous, rusty and much oxidized. (2) Cemented gravel; stratified, rusty and gold-bearing. (3) Stratified alluvial clay; sandy, alternating with gravel; sometimes carrying fine colors of gold. (4). Glacial boulder clay, carrying no gold. (5) Stratified gravel, cemented, carrying gold in some regions. (6). Sand and gravel in alluvial layers.

Pipe Clay and Quicksand

In the Chaudière valley, pipe clay and quicksand, probably of Tertiary age, occur at various places immediately below the boulder clay, on the Gilbert river and in the lower part of the Ruisseau des Meules. Their presence caused some trouble in underground mining many years ago, owing mostly to improper drainage methods. The boulder clay, which was deposited during the glacial

epoch, forms large beds in places; indeed it may be said that where the alluvial deposits are thick, almost two-thirds is taken up by this material, as for instance, in the lower part of the Gilbert river and near Jersey Mills, where thicknesses of from 20 to 70 ft. have been recorded in shaft sinking.

Richest Deposits

As to the distribution of the gold-bearing gravels, it may be said that they are confined to almost every river and creek emptying into the Chaudière river and to the latter proper, from the Rivière des Plantes up to the Rivière de Loup, a distance of about 16 miles, and scattered occurrences are recorded higher up the Chaudière river as far as Trout creek and beyond. But work for the last 60 years has demonstrated that by far the richest deposits have been found along the Gilbert river, the Ruisseau des Meules and the des Plantes river, within the confines of the Seigneury Rigaud de Vaudreuil.

Of the $2,000,000 of gold produced in Beauce county, according to the government reports, over $1,000,000 has been credited to the diggings of the Gilbert river.

The official government reports contain some authentic information regarding the finds of large nuggets, as well as some of the largest yields on record. The largest nugget, the so called McDonald nugget, was found on Lot 16 of the De Lery concession on the Gilbert river; it weighed 45 oz. and 12 dwts., and was valued at $851.26, a facsimile being in the museum of the Geographical Survey at Ottawa. In 1863, Jean Mathieu, a prospector, washed out $500 in four days from a spot on Lot 20, on the Gilbert river. In 1867, John McRae obtained a total amount of 334 oz. of gold on Lot 15, from an area 75 ft. square from July to October, and it is estimated that from this spot alone about $50,000 were taken out up to the end of 1863. Government royalty was paid by a Mr. Nash, in 1867, on a yield of $20,000 from a claim 50x200 ft. on Lot 13, though it is asserted that he took out twice that amount. The St. Onge brothers, in 1877, found a 42-oz. nugget, worth $756, on Lot 12, and it is reported that they took out about $85,000 from their claim, measuring 135x600 ft. The same men are reported to have produced $40,000 from a ¼-acre claim on Lot 13, from a depth of 70 feet.

On the Ruisseau des Meules, A. Conpal, a miner, took out from $8000 to $16,000 in one season by open cast and underground work and with crude appliances. But the most striking example of the richness of some alluvions is one of the recent cleanups, Aug. 15, 1911, made by the Champs d'Or Rigaud Vaudreuil Company, Ltd., from the tailings of the Conpal works, just referred to. About 7000 cu.yd. of this washed ground, which contained a large number of big boulders, were subjected to hydraulicking and yielded 36c. per cu.yd. If we also take into consideration, say only $8000 of what Conpal obtained, we have a yield of $1.50 per cu.yd. of the virgin ground.

These examples may suffice to throw some light on the quality of the gold alluvions and the mining capabilities of the region; if the methods applied in the earlier days had been of the modern California type, it is possible that the history of this camp would have offered different reading, as far as the stability of the different enterprises were concerned.

Early Mining Shallow

Only in a few places has underground mining been continued to any depth, say to 60, 70 and 80 ft., and here, too, sometimes great difficulties were encountered in checking the inflow of water and quicksand, due to a large extent to the inadequate appliances in vogue at that time. Underground mining was even attempted and carried out in deposits of only 20 ft. depth, in some places with such an influx of water that the miners are said to have stood knee deep getting out the pay dirt. Shallow places, as a rule, were turned over and over, and washed with no other appliances than pick, shovel and the common sluice box. It is evident that with such primitive methods and appliances great losses of gold were incurred, and consequently the ground had to be of a high tenor to pay for working. As a matter of fact, according to tests, even considering the low wages paid at that time, on an average $1 per day, ground yielding less than $1.50 per cu.yd. would only pay expenses and nothing more. In the deep deposits no other method than underground work is at present applicable, though through the introduction of modern hoisting, pumping and winning appliances, expenses per cubic yard may be greatly reduced. There are alluvial deposits, however, distributed over the Beauce district which, by reason of their richness, situation, depth and water facilities, would certainly be considered as inviting and encouraging prospects if they were situated in some other well known gold-mining district and would offer a great opportunity for the application of those California mining methods which, through their effective devices, have made the mining of low-grade alluvials a possibility.

Thorough Testing Necessary

Before entering upon the installation of such expensive plants in any one region, it is important that tests be made down to bedrock, either with a hand or power drill or by shafts. Experience has shown that some of the occurrences are sporadic, that the old river channels, which carried the gold, terminate abruptly, or thin and widen out, suddenly turn their course in an altogether unsuspected direction or follow a general course altogether different from that indicated by the rims. All these pranks of Nature play an important part in the preliminary tests. They must be investigated and taken into account, lest the final results be misleading, and hopes entertained for successful exploitation where there should be none.

Cyanide Plants in the Black Hills, South Dakota

The following list of cyanide plants in Lawrence county, South Dakota, is furnished by our correspondent:

Homestake Mining Company; T. J. Grier, superintendent, A. J. Clark, metallurgist, Lead; sand plant No. 1, at Lead; treats 1700 tons of tailings from amalgamation mills per day; sand plant No. 2, at Black Tail, has a capacity of 800 tons of tailings; slime plant, at Deadwood, has a capacity of 1700 tons of tailings.

Mogul Mining Company; Charles Ellis, superintendent, Pluma; capacity, 3500 tons of silicious ore.

Golden Reward Consolidated Gold Mining and Milling Company, Deadwood; Henry Schnitzel, general manager, Lead; capacity, 250 tons; will probably be increased shortly.

Wasp No. 2 Mining Company, Flat Iron (or Yellow Creek); John Gray, superintendent, Terraville; capacity, 400 tons of silicious ore.

Lundburg, Dorr & Wilson; J. M. Pennington, superintendent, Terry; J. V. N. Dorr, Equitable building, Denver, Colo.; capacity, 100 tons; treats own and custom ore.

Trojan Mining Company (includes Portland mine and American Eagle mill); H. S. Vincent, superintendent, Portland; under construction, but will operate shortly with a capacity of about 300 tons.

Bismarck Consolidated Mining Company, Flat Iron (adjacent to Wasp No. 2); F. B. Hitchings, general manager; address, probably Deadwood; under construction; probable capacity, 300 tons.

North Homestake Mining Company, Maitland (Garden City district); formerly Maitland Mining Company and Penobscot Mining Company; L. M. Maitland, superintendent, Maitland; not in operation at present.

Imperial Gold Mining and Milling Company; R. S. Jamison, general manager, Deadwood; not operating.

Hidden Fortune Mining Company; Kirke S. Phillips, receiver; Deadwood; not in operation.

Reliance Mining Company, Annie Creek; recently resumed operations on a small scale.

The following mills are not now in operation: Gilt Edge Maid Gold Mining Company; Branch Mint Mining Company; Puritan Mining Company; Golden Crest Mining Company, R. L. Bailie, president, Deadwood.

A Trip to Przibram, Bohemia

By O. H. Hahn *

About one-fourth of the Austrian lead production comes from this famous district. The mines are now declining. The metallurgy at the government-owned reduction works is described.

*Metallurgist, Schillerstrasse 6, Jena, Germany.

Among the lead-producing countries the Austro-Hungarian monarchy does not occupy a conspicuous place, yet its consumption of that metal is strikingly in excess of its production. According to the statistical compilations of the Frankfurt Metal Company, Austro-Hungary produced in 1910, 17,500 metric tons of lead, while it consumed 31,500 tons, thus leaving 14,000 tons to be imported from other countries.

Government Smelting Plant at Przibram

Of the 17,500 tons of lead produced in Austria last year, only 4000 tons were from the government smelting works near Przibram, Bohemia. The situation of the Przibram works, the largest and most complete of the monarchy, almost exactly in the center of Bohemia, is due to the existence, a short distance west of the town, of a cluster of silver and lead mines, which have been worked for several centuries and possess some of the deepest shafts extant.

The ores occur in veins traversing a sandstone of Silurian age known as graywacke. There have been exploited about 40 of these veins within an area 5½ statute miles long by 3 miles wide. The veins range in thickness from 1 in. to 12 ft. and have a general trend of north and south dipping steeply to the northwest, while the country itself runs northeast and southwest. Diabase dikes also traverse the country, but do not interfere with the veins, the latter being of more recent origin than the former. In some cases the veins even form contacts between graywacke and diabase. The main filling of the veins is quartz, spathic iron (siderite), calcite and brown spar (ankerite), of less frequency barite and dolomite spar. The ores imbedded in the vein matter consist chiefly of argentiferous galena and sphalerite, some chalcopyrite and some tennantite with which were formerly associated a variety of silver ores that are now almost exhausted. Credner the Elder likened the veins of Przibram to those of St. Andreasberg which would not augur well for a much longer life of the former.

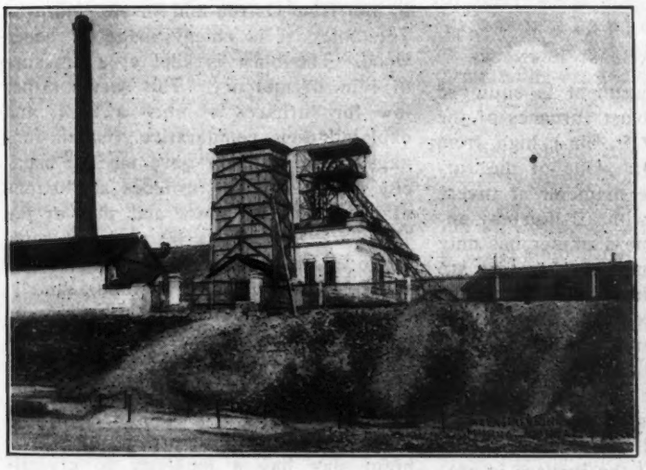
Adalbert Vein Worked to 1200 Meters

The most important vein of the Przibram district is the Adalbert vein which has been explored to a depth of 1200 m. It is systematically worked through several perpendicular shafts. I was permitted to go down to the 32d level of the Maria shaft, 3638 ft. deep, from which a crosscut had been run to the Adalbert vein and connection had been made with the Anna and Adalbert shafts by a level about one mile long for hauling and ventilating purposes. The country rock is so hard and solid that it requires no timbering except where it joins the underlying clay slate and in the stopes. In some places the roofs of the drifts were supported by brickwork laid in cement. On the whole, the mine is very dry; the small amount of seepage water from the upper levels is collected in sumps and pumped up by air-driven duplex pumps to the *Erbstollen*, an adit which drains all the mines. The air is good, but its temperature is rather high. The ore is blocked out in squares, 50x56 m., and extracted by overhand stoping, either by hand or with stope drills. The levels are opened by machine drills. The waste rock is used for stope filling. The vein I saw did not impress me as promising remunerative returns; it was not over 1 ft. wide and glistened with blende. Possibly it may bulge out as work progresses. According to the statement of the foreman it takes eight years to extract the ore from one block, and at that rate the mine is good for a number of years yet.

Hoisting in Double-deck Cages

After being roughly sorted in the mine the ore is hoisted to the surface in cars on double-deck cages. The miners descend and ascend the shaft by an old-fashioned man engine, while the timbermen and the other mechanics use the cages. As a cage holds only five men and is raised at the rate of four meters per second, it takes five minutes to get to the surface, or to the bottom of the shaft provided there are no stoppages on the way.

The man engine handles a much larger number of men in the same time, but does not offer the same amount of safety as a cage. The wire rope used in hauling at all the mines is manufactured at the government shops close by. Upon arrival on the surface the medium-grade ore is trammed to hand-picking sheds where the first-class ore and the argentiferous blende are culled while the refuse is sent to the dressing works near by. Owing to the sphalerite being argentiferous the concentration is not carried up higher than 60 per cent. Pb, in order to avoid heavy silver losses by the floating off of the former.



The Maria Shaft at Birkenberg, Bohemia

Przibram Silver-lead Smelting Works

The Smelting Works

The first-class ore and the concentrates are sent to the smelting works which is situated at the confluence of two creeks northwest of the town of Przibram, about an hour's walk from there by the turnpike road to Pilsen. The smelting plant is connected with the state railway depot by a spur, for freight traffic only, and is surrounded by a high wall of masonry thus making it nearly impossible for anyone to enter the premises except through the main gate and in sight of the gatekeeper. The buildings in which the different departments and materials are housed are of the most substantial construction and well ventilated. I had seen the works in 1889 when it had been brought up to date. Since then two radical changes have been made:

(1) The roasting and slagging of the ore in Freiberg long-hearth furnaces has been discarded and replaced by treatment in the Savelsberg converter, whereby metal losses and cost of labor have been reduced.

(2) The slow and cumbersome Rozan-Pattinson process for desilverizing the furnace bullion has been superseded by the Parkes zinc process which gives quicker returns, although it is claimed that the merchant lead resulting therefrom still carries bismuth in objectionable quantity. This claim is open to doubt as the bismuth follows the silver. Other minor alternations that have been made will be mentioned later in the course of this article.

Composition of the Ore

I could not get hold of an analysis of the ore of today, so I shall here append the average composition of the ore smelted in 1887 as follows, given by Zdráhal[1]: PbS, 45.09 per cent.; AgS, 0.313; Cu_2S, 0.120; ZnS, 8.73; Sb_2S_3, 1.07; As_2S_3, 0.84; FeS_2, 4.65; $FeCO_3$, 13.77; $MnCO_3$, 1.61; $CaCO_3$, 1.75; $MgCO_3$, 0.57; Al_2O_3, 1.69; SiO_2, 20.05 per cent. Total sulphur computed therefrom 12.04 per cent.

This does not look so bad when compared with the conditions so graphically described by Percy and Kerl[2] when the ore had 20 per cent. of blende and 10 per cent. of silica. In those days frantic efforts were made to find a process by which the difficulties caused by the deleterious action of the zinc would be overcome, but no relief was obtained until better modes of dressing and more appropriately constructed furnaces were brought into use. It looks ludicrous now to read of the feats alleged to have been achieved by such a furnace as the one of Vogl's (Joachimsthal) construction; a clear case of self-deception.

Blast Roasting without Limestone

The Savelsberg process as originally devised is a lime-roasting process, but it has been found here that lime could be dispensed with in the converter without prejudice to the operation and that an addition of 20 per cent. of spent pyrites to the ore would be more beneficial. This fact and some alterations in the construction of the converter have been instrumental in expunging the name of Savelsberg. In this connection I might mention that St. Andreasberg spathic iron has been used successfully in the Huntington-Heberlein converter instead of lime.

There are 13 converters at the Przibram works, 12 of which are in constant operation while one is kept in reserve. The charge is eight tons, including 20 per cent. spent pyrites, or 6.4 tons of ore, net. The spent pyrites are purchased from sulphuric-acid works in Bohemia. There were formerly in operation 12 long-hearth roasting furnaces, capacity 4 tons per 24 hours, but only a portion are used now for agglomerating flue dust.

Eight Circular Blast Furnaces

The smelting department is equipped with eight circular blast furnaces of the Pilz type, 9 m. (29 ft. 5in.) high from tapping to feed floor. One of the furnaces is 2 m. inside diameter at tuyere level and provided with 10 tuyeres; another one of the same diameter has only 7 tuyeres, the remaining six furnaces are 1.4 m. (4 ft. 7 in.) in diameter and have 8 tuyeres. The tuyeres are only 3 cm. (1⅛ in.) in diameter at their mouths as against 3½ in., more or less in the United States. The blast for the furnaces and converters is supplied by two blowing engines and two Roots blowers.

The hottest part of the furnace is provided with three sets of cast-iron water jackets with brickwork intervening between each two sets. The furnaces are worked with a closed breast and have a water-cooled slag tap. They are also provided with the Arents siphon tap from which the lead bullion is allowed to run continuously into a tapping basin.

The furnaces are open at the top and receive their charges through a sheet-iron cylinder suspended from it and reaching into the furnaces far enough to protect the gas flue from obstructions. On rails laid across the furnace top a car having a movable cylindrical box of boiler plate and a conical bottom of cast iron on which the charge rests is run over the center of the furnace and emptied into it by raising the box with a lever attachment. The car is hoisted from the mixing floor to the charge floor by means of a steam elevator.

The fuel (coal and charcoal) is trammed directly to the furnaces from the coal sheds and dumps situated on the same level. The furnace gases are drawn off at the side of the furnace and conducted into dust chambers, each furnace having a separate set of them. The dust chambers are connected with a high stack through which the gases deprived of flue dust are discharged into the open.

The Smelting Mixture

The smelting mixture is made up of roasted ore and lead matte, furnace barrings, pot and cupel dross, cupellation-hearth bottoms, agglomerated flue dust, spent pyrites, cast iron, mill cinder, limestone (very pure) and slag from ore smelting in the same amount as ore. According to Zdráhal, the average content of the smelting mixture for one year has been 21.2 per cent. Pb and 0.0963 per cent. Ag (28.08 oz. per short ton). This would make a bullion of 132.4 oz. Ag per ton. The smelting mixture is smelted in charges of 13 dz. (double centals[3]) with 150 kg. coke and 4 hectoliters (@ 13.3 kg.) of charcoal, equal to 203.2 kg., or 15.6 per cent. fuel. The coke is said to contain 10 per cent. ash and 5 per cent. moisture and is brought by rail from Ostrau and Rossitz, Moravia. The charcoal is chiefly made of beech wood. The blast is kept at a pressure of 1 in. of mercury. This seems rather low for furnaces of such a hight and explains their comparatively small tonnage. The manager gave me the capacity of the smaller furnaces as 40 tons of charge in 24 hours and that of the 10-tuyere furnace as 60 tons. According to Zdráhal, the tonnage of the smaller furnace was still less in 1888, namely, 31.2 tons in 24 hours.

The resulting slag carries 32 per cent. silica, and is quite correct according to what I saw of it. It did not show any zinc color in the slag spout. According to older metallurgical writers the Przibram slag has a tendency to crystallize, which is quite plausible. It is tapped into conical pots and after cooling, freed from the button of matte and broken up. The impure part of the slag is saved for resmelting, the remainder assaying about 1 oz. Ag and 1.5 per cent. Pb is going over the dump. The lead matte which assays about 10 per cent. Pb and 1½ per cent. Cu, is treated like the ore and smelted with it. When it reaches the grade of 20 per cent. Cu it is taken out of the cycle of operations and shipped to the government's copper smeltery at Brixlegg in the Tyrol for further treatment.

Refining the Base Bullion

The furnace bullion is ladled from the tapping basin into disk-like molds and

[1]Monograph, "The Silver-Lead Smelting Works at Przibram," by Zdrahal in "Berg- u. Hüttenmännisches Jahrbuch der k.k. montanistischen Hochschulen zu Leoben u. Przibram," Vol. 38, 1890.

[2]Percy, "Metallurgy of Lead," London, 1870. Kerl, "Handbuch der metallurgischen Hüttenkunde," Vol. II, Freiberg, 1863.

[3]Dz. stands for double cental, also called quintal, or metric cental of 100 kg. This is the Austrian unit of weight for bulky objects.

liquated in a furnace on the same floor. The dross remaining in this furnace called *saigerdörner* is raked out and reserved for a special smelting operation. The liquated bullion is cast into bars and hoisted on an elevator to the refinery floor adjoining, where it is subjected to the zincking process. It is zincked three times as in most refineries of the United States. The first or copper-gold alloy is retorted in one of two Faber du Faur tilting furnaces, the second, is liquated in a furnace on the refinery floor and the dry alloy retorted in the second Faber du Faur furnace, while the liquated bullion goes with the first bullion back to the zinc pot. The third alloy is used over again in zincking. The Faber du Faur furnaces are of small capacity, the retorts holding only 240 kg. They are at present fired with coke, but it is contemplated to use producer gas at no distant day. Why not Gallician fuel oil, so near within reach? When the Rozan-Pattinson process was in operation, the resulting silver bullion contained 0.006 gold. By using the zinc process a doré bullion of a higher grade is produced.

Refining the Desilverized Lead

The desilverized lead is refined in lots of 24 tons in a reverberatory furnace with a movable roof. Its sides are lined with magnesia brick and the fire bridge is cooled by air blown into a cast-iron box which is laid through its axis. The flue end is cooled in the same manner. The firebox is provided with an undergrate blast and the fuel is soft coal.

Blast is not turned on the metal bath until the first dross has been drawn and litharge begins to form. When the latter assumes a yellow color the refining operation is finished and the metal is allowed to cool for five hours. It is then tapped and run into molds set up in a semi-circle around the taphole in the same way as in American refineries. This soft lead is remelted in iron kettles and cast into bars ready for the market. Each bar is stamped with its weight. The merchant lead is very pure. The pattinsonized lead contained beside slight quantities of Ag, Cu, Sb, Fe, Ni and Zn., 0.0021 per cent. Bi. It would be interesting to know the proportion of bismuth in the merchant lead from the Parkes process, but no analysis of the latter has yet been published.

Cupelling Operations

In a building by itself there are six large German cupelling furnaces, in sets of two, and two smaller ones which are used as *spleissöfen*. In a room partitioned off by a heavy wall there is a strong room or vault for the safe-keeping of bullion and other valuable metallics, and a refining furnace. All these furnaces are provided with movable roofs.

The cupelling furnace capacity would appear larger than necessary if it were not for two points: (1) The Pattinson process requires a larger amount of silver-lead to be cupelled than the Parkes process, and (2) the demand for litharge is sometimes large. So it was during my visit in 1889; at present the plant is overstocked with litharge and will not be required to make any for several years to come.

The German cupelling furnaces, as also the *spleissöfen*, receive a bottom of artificial marl, i.e., a mixture of 90 parts of limestone and 30 of loam, crushed and ground to pass a 1-mm. screen. The capacity of a cupelling furnace is 24 tons of rich lead which is cupelled to a *blicksilber*, 950 fine, in 72 hours. The dross obtained before putting on the blast and the pure litharge go back to the ore charge, the intervening black litharge furnishes the basis for the manufacture of antimonial lead. The firebox of these furnaces is like that of the lead-refining furnace, provided with an undergrate blast and the fuel used is soft coal and lignite from northern Bohemia. The blast is furnished by a Roots blower in the same building driven by a water-wheel.

The *blicksilber* is refined on a test of marl using flue ashes and charcoal slack to take up the impurities. No blast is used. The fine silver is ladled into a granulating vat and shipped to the Vienna mint in the shape of shell-like granulations.

There should be another furnace for the doré silver, but I suppose it had not been put up yet as the inauguration of the Parkes process had only taken place a short time prior to my visit and was not yet in full running order.

Saigerdoerner Smelting

In addition, two smelting operations of byproducts are carried out periodically according to stock in hand: (1) The working of the *saigerdörner* or dross from the liquation of the blast-furnace bullion, and (2) the manufacture of antimonial or hard lead.

The *saigerdörner* are a mixture of lead oxide and sulphide with metallic lead, sulphide of copper and arsenides and antimonides of nickel and iron. They are smelted with roasted lead matte and slag from ore smelting in a blast furnace and yield a copper-lead bullion, lead matte with 8 per cent. Cu and also some speiss. The lead bullion is liquated again and then treated the same as the liquated ore-furnace bullion; the dross is united with the first *saigerdörner*. The matte is roasted and concentrated to 20 per cent. Cu, when it is shipped to Brixlegg.

Smelting for Antimonial Lead

To obtain the material for this operation the black litharge from the cupellation process is melted in one of the *spleissöfen* on a bed of charcoal slack with a reducing flame and undergrate blast. A charge of 4 tons of black litharge on a bed of 3 hectoliters (@ 2.84 bushels) of charcoal slack, is finished in 16 hours and yields hard-lead slag (*verblasenschlacke*) and lead bullion with about 8 oz. Ag which goes to the refinery. The hard-lead slag which contains principally lead oxide (43 per cent. Pb), antimonious oxide (with 27 per cent. antimony), arsenic anhydride (7 per cent.) and some silica, alumina, lime and oxides of the heavy metals, is smelted in a blast furnace with skimmings from the lead well and from remelting of lead and poor slag from the ore furnaces, with 33⅓ per cent. of fuel (coke, or coke and charcoal mixed). The addition of lead-well skimmings does not seem to me to be good policy as they are liable to carry silver into the hard lead.

The hard-lead furnace differs somewhat from the ore furnaces in that it is charged by hand through a door in the back wall, which involves a superstructure terminating in a chimney, and it cannot be run with an Arents lead well. The antomonial lead has to be tapped periodically into a tapping basin on the smeltery floor and molded from there. It is then remelted in a cast-iron pot holding 16 tons and poled with steam. The dross produced thereby is skimmed off and the hard lead cast into ingots, provided samples taken from the pot show the guaranteed amount of 20 per cent. antimony.

The second dross obtained in refining the desilverized lead contains tin. It is, therefore, kept separate and smelted for tin-lead as soon as a sufficient quantity of it has accumulated. For the manufacture of lead pipe and plate, there is a rolling mill and a pipe press provided in a building facing the refinery.

Mechanical Equipment

The power for driving the machinery is generated by steam with the one exception already mentioned. In the main power house opposite the blast-furnace building there are four engines of 155 h.p. in the aggregate, to drive two blowing engines, two Roots blowers and one dynamo for electric light. The boilers are in a separate building in the rear of the power house. In the blast-furnace building there are two hoisting engines. Another lot of machinery and boilers are in the receiving shed where lump ore, matte, limestone and other bulky material are crushed in Blake crushers and ball mills.

Since all the ore is used in a pulverized state, the sampling does not present any difficulty and is done by hand. The determination of moisture is rather antiquated inasmuch as it is arrived at by drying a weighed quantity of ore over a charcoal fire.

The water supply is derived from a storage reservoir to the west of the works, holding over 700,000 cu.ft.; the

water passes through a clearing pond before use in the boilers, water jackets or for other purposes.

The arrangements for the sanitation of the employees, including a canteen where beer only is dispensed, are all that could be wished for. The number of workmen directly employed at the works was given to me as 420. The ore smelted during a year amounts to from 23,000 to 25,000 tons. The yield in 1910 was 4000 tons of lead, 48,000 kg. (1,543,200 oz.) of silver and 7 kg. of gold. The latter is chiefly of outside origin from mint sweeps.

Hydraulic Mining in California

Hydraulic mining was highly developed in California from small beginnings and great perfection was attained, especially in magnitude of operations. From 1870 to about 1883 this method of mining was at its culminating stage. The enormous scale on which it was practiced necessitated the dumping of exceedingly large quantities of débris into the narrow gorges of the torrential streams of the Sierra Nevada range. These streams rapidly carried the tailings down to the Great Valley. Here the river channels became choked, overflows damaged the value of the land of the Great Valley, and fears were entertained that the lower Sacramento river would soon cease to be navigable and that San Francisco bay would suffer from the deposition of the fine silt. In 1908 the total production of gold from hydraulic mines in the Tertiary gravels of the Sierra Nevada of California amounted to only about $170,000[1].

Large Initial Expenditures Required

The opening of a hydraulic mine requires a great deal of capital for the construction of the necessary ditches and bedrock tunnels. It is rare that sufficient water can be obtained in the vicinity of the mine. Each large hydraulic mine usually has its own system of extensive ditches carrying the water from the upper rivers or from artificial storage basins in the high Sierra.

These ditches furrow the cañon sides of the more important rivers of the range and the total amount of money invested in such enterprises, as estimated by Hammond, doubtless approaches $100,000,000. With a prohibition of hydraulic mining on a large scale many of these water systems became useless for the purpose intended, and have for the last 20 years been used largely for irrigation and power. It is generally impossible to carry on hydraulic mining by following the old channels, and artificial outlets must be constructed for the débris, and thus long tunnels have been run, piercing the rim of the deposit from a neighboring cañon side. In these tunnels the long sluices are generally contained, and below their portals are a number of so called undercurrents in which the gravel is comminuted by successive drops and the fine gold caught. The tunnel of the North Bloomfield Company in Nevada county is 7874 ft. long and cost about $500,000. As long as simply the upper gravels are worked, such tunnels are not necessary, but as the principal pay is near the bedrock they become, sooner or later, a necessity for most hydraulic mines.

High Banks Washed in Benches

From the bulkheads the water is carried down to the working place in wrought-iron pipes, mains 22 in. in diameter being used in many of the large mines. The pressure used is often equivalent to 200 and 300 ft. The stream is discharged from monitors or giants with nozzles from 4 to 9 in. diameter. The amount of water used for each monitor is sometimes as much as 500 miners inches. or about 5000 gal. per min. The gravel banks attacked are, in places, over 200 ft. in hight, but it is usual to divide such banks into two or more benches. Previous to disintegration by the stream of water, the bank is generally blasted to loosen the gravel. Small tunnels are driven into the bank and crosscuts from them parallel to the face of the bank. In these crosscuts large quantities of low-grade dynamite are exploded.

The sluices are usually lined with heavy planks and paved with rocks or wooden blocks, between which the gold settles. The sluices are invariably several hundred feet and at some times several thousand feet in length, and their grade is usually from 3½ to 4½ per cent. Quicksilver is always added to the sluices in order to catch the gold. Since the prohibition of the dumping of debris into the rivers of California, hydraulic elevators have been used at some places in order to deposit the tailings in neighboring pits. By means of these elevators the gravel washed from the bank is forced up through a pipe by water under heavy pressure.

[1]"The Tertiary Gravels of the Sierra Nevada of California." Professional Paper No. 73, U. S. Geol. Surv.

Test of a Drier for Iron Ore

By driving off the moisture from soft wet iron ore, the dried product becomes more readily salable. In reducing the moisture from, say, 21 per cent. down to 8 per cent., the ore is discharged by the drier in nodules varying in size from that of peas to that of marbles. It is the interstices between the nodules that reduce the resistance to the blast as offered by fine ores when charged wet. A recent test made on a Ruggles-Coles A-10 drier at the Pequest Company's No. 3 mine, Buttzville, N. J., shows the performance of a machine drying soft iron ore. The results are given in the accompanying table.

ORE DRYING TEST AT PEQUEST MINE NO. 3, BUTTZVILLE, N. J.

Test No.	1	2	3	4	5
Temperature of atmosphere, deg	73	74	76	78	88
Temperature of ore mined, deg	59	59	59	59	60
Temperature of ore discharged from drier, deg	116	126	122	135	185
Temperature of fan exhaust, deg	120	130	114	124	
Per cent. of moisture in ore mined (all-day average)	22.4	22.4	22.4	22.4	20.29
Per cent. of moisture in material discharged from drier	8.0	3.1	9.3	10.1	8.34
Per cent. of moisture in material after standing 24 hr. in office	4.3	1.6	7.9	8.5	
Amount of material fed to the drier in tons per hour	5.447	6.607	7.611	5.890	17.59
Time, minutes	60	75	60	45	60
Rate per hour, tons	5.447	5.29	7.611	7.83	17.59
Fuel oil burned, gallons	18	26.812	23.75	18.24	67.5
Fuel oil burned per ton of ore delivered to drier, in gallons	3.30	4.06	3.12	3.10	3.83
Lb. of water in one ton of ore as mined	448	448	448	448	405.80
Lb. of water in ore as discharged by drier	135	50	159	174	145.05
Lb. of water evaporated per ton of ore delivered to drier	313	398	289	274	260.75
Water heat, B.t.u	47,890	60,890	44,220	41,920	39,634
Heat of evaporation	302,700	384,900	279,700	265,000	252,145
Material heat	22,120	26,000	24,440	29,490	49,819
Heat in water in material discharged by drier	7,695	3,350	10,020	13,220	18,131
Total heat, B.t.u	380,405	475,140	358,180	349,630	359,729
Heat in fuel oil burned per ton of ore delivered to drier	434,500	533,500	410,300	407,200	503,568
Efficiency of performance, per cent	87.55	89.05	87.31	85.87	71.04
Tons of ore to be mined per ton of dried ore delivered	1.186	1.249	1.169	1.159	1.149

The Zinc Industry in Belgium

The zinc-smelting industry in Belgium in 1910 comprised, according to *Annales des Mines de Belgique*, 13 smelting plants employing 7745 workers. There were also in operation 10 rolling mills employing 734 men. The smelteries in Belgium are engaged exclusively in the treatment of foreign ores, amounting in 1910 to 424,190 tons, with a fuel consumption of 897,850 tons, and a production of 181,745 tons of spelter, being an increase of 4.2 per cent. from a production of 1909. The total value of the production in 1909 was 103,540,900 fr. Of the total spelter produced, 47,970 tons were rolled into sheets.

The Biwabik Iron Mine

By C. A. Tupper*

Oldest mine on Mesabi range. Has maintained a large, profitable production by use of uptodate methods and machinery. It uses the largest gyratory crusher ever built.

*Consulting engineer, 389 Thirty-first avenue, Milwaukee, Wis.

This article is intended to describe the operations and tell something of the factors contributing to the successful management of the Biwabik mine, the oldest on the Mesabi iron range. Looking back over the developments of the last decade, it is interesting to note that the extensive ore deposits of this district, which produces the largest tonnage of any in the world, were discovered and first exploited at what is now Biwabik, Minn. The original discovery came about through the uprooting of a tree in a gale, and the revelation at its roots of a quantity of hematite ore.

Exploration Began in 1892

Exploration of the property was systematically begun in 1892 by J. A. Brown. In 1893 the Biwabik Ore Company was organized by J. T. Jones, now of Iron Mountain, Mich., and P. L. Kimberly, of Sharon, Penn., since deceased; the first shipment was made in that year. In May, 1897, the property was acquired by the Biwabik Mining Company, three-quarters of which is owned by the Youngstown Steel Company and the Briar Iron and Coal Company, both of Youngstown, Ohio, and one-quarter by the Oliver Iron Mining Company, of Duluth. The mine is operated under lease on a royalty basis.

It was here, also, that the first stripping was done on the range by means of a steam shovel; the latter was a Marion, style A, built in sections and hauled in from Mesaba, then the nearest railroad station, about 10 miles away. This shovel was a friction machine, carrying a 1½-yd. dipper and weighing 40 tons. J. D. Shilling, now superintendent for the Utah Copper Company, at Bingham cañon, Utah, was in charge of the earliest operations, and remained until 1902 when he was succeeded as superintendent of all of the Biwabik Mining Company's operations by his assistant, J. S. Lutes, who is still in control. The latter has been connected with the company for over 15 years.

Deposits Are from 50 to 300 Ft. Deep

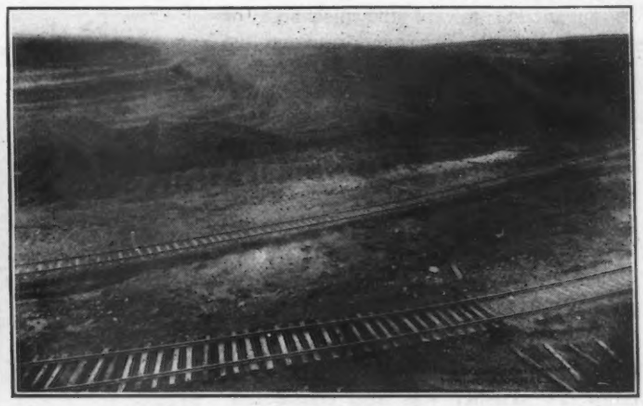
The deposits now being worked dip to the south about 10 deg. and have a depth of 50 to 300 ft. Almost solid seams of hard ore cover several acres in a stretch. The intermediate layers are pure taconite, broken up and showing movement, and "paint rock"; the layers are thus, practically, lean iron ore. The overburden averages 80 ft., as against an average of about 65 ft. for the entire range. By proper selection, a good smelting mixture can be obtained, the shipments averaging approximately as follows: Bessemer—iron, 55 per cent.; silica, 5.50; phosphorus, 0.045. Non-bessemer ore averages 51.50 per cent. iron and 6 per cent. silica. The silica is mostly in the form of pure taconite, about 5000 tons of which can be included in a run, say, of 300,000 tons. This company was the pioneer in systematic mixing at the mine, it having been inaugurated in 1900.

Six Steam Shovels Used

For stripping and loading, the company now has in service one Marion and five Bucyrus steam shovels, each with a dipper capacity of 3 cu.yd. The drilling is done on the bench system by means of six Ingersoll pneumatic drills and the holes vary in depth, some being from 21 to 24 ft. Both the fuse and electric systems of firing are used, the latter being adapted particularly to the deeper holes. Blasting is so ordered and arranged that approximately the right mixtures are obtained in the heaps composed of ore from the different benches. The ground also has been so mapped out that a selection of the ore to be blasted and loaded can be taken much as a foundryman selects the cupola charge from the heaps of pig iron in the yard. Samples are, however, taken in four- to 10-car lots and regular assays made in the laboratory.

From the mine the ore is transported to the crushing plant on 10-ton larries of the company's own pattern, which have 5½-ft. clearance for the discharge when open. These will be replaced in the near future by new all-steel cars, so reinforced by side angles as to insure long service. Each train of seven cars is hauled up an incline and can be dumped directly into the receiver of the breaker in 3½ min., without the use of air, each car being successively emptied without uncoupling.

South End, Biwabik Pit



Operations at North End

Breaker Is Largest Ever Built

The breaker, set on a concrete foundation, is a No. 24 Allis-Chalmers machine, with a 48-in. opening, being the largest gyratory crusher ever built and the first of over No. 9 size to be installed in this country by a mining company for any class of service. The Biwabik company was also the pioneer in the use of the No. 9 breaker, in 1901, which was then regarded as a monster and made a record run for that time. The object of the No. 9 breaker was to avoid reblasting and to permit handling of rock which could be loaded by steam shovels and hauled to the crushing plant in cars of larger size than those previously in serv-

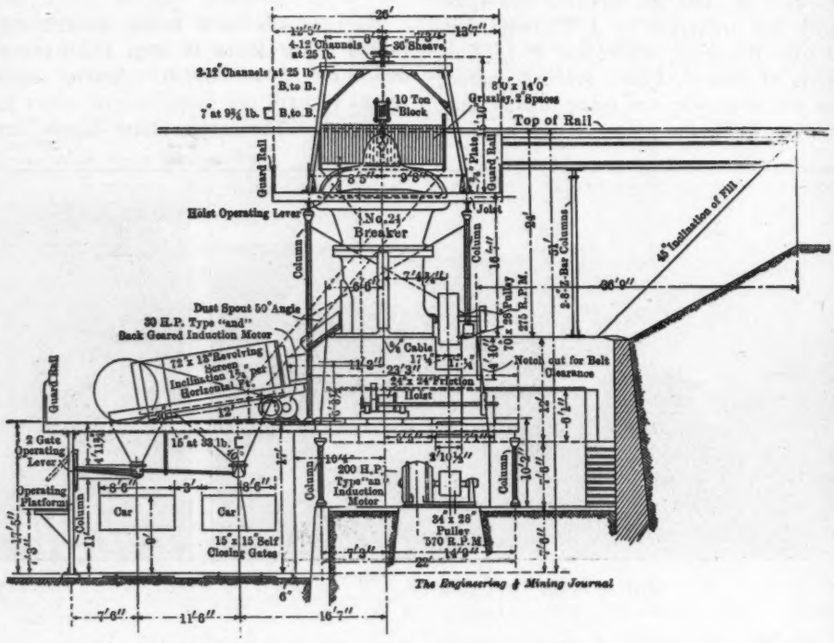
ice. The desire for further economies led to the use of much heavier steam shovels, to the end that still less redrilling and reblasting might be possible, and a breaker larger than the No. 9, therefore, was demanded. The management, however, did not feel satisfied to install one any smaller than would handle the heaviest pieces lifted by a modern 3-cu. yd. shovel, and it was not until the Allis-Chalmers company had developed a breaker with a 48-in. receiving opening that it was decided to substitute it for the No. 9 machine, which has a 21-in. opening. The present No. 24 breaker is driven by belting from a 3-bearing, induction motor of 200 h.p., at from 570 to 600 r.p.m., carrying a 34x28-in. pulley, and has attained a capacity exceeding 1000 tons of ore per hr., it being merely a matter of getting the cars to the dumping platform fast enough.

The ore first passes over a grizzly, with bars spaced 2 in. apart, and the undersize falls through a spout at 50 deg. angle, to one of two shipping bins, together with the product from the breaker which passes the 2-in. perforations of a 6x16-ft. revolving screen, set at an incline toward the discharge of 1¼ in. per ft. The oversize from the screen, from 2 to 5 in., is delivered to the other shipping bin. A 30-h.p., back-geared, induction motor, at 900 r.p.m., drives the screen. From the bins the ore is delivered, through 15x15-in., self-closing gates, to cars on two tracks directly underneath. The gates are opened by a hand lever from a raised platform.

Gyratory Type More Efficient

When the construction of this plant was being planned the installation of a large jaw crusher was also considered. The decision, however, was in favor of the gyratory breaker, not only on account of its continuous crushing action, with freedom from shock, thereby requiring a less expensive foundation and decreasing the liability of breakage of parts, but also on account of the large circular receiving opening, giving a much better opportunity for receiving the discharge from an entire carload of ore into the breaker without having chutes leading to it filled with material. As an illustration of the immense receiving opening of the new Biwabik breaker, which is 48 in. clear between crushing surfaces and 125 in. long, it is interesting to note that the grizzly above mentioned is 14 ft. wide across.

The spider of the breaker is of the high curved type, the arms being arched widely over the top of the head and concaves; it is this construction that prevents any bridging of the ore, which has free access to the crushing surfaces. As the ore does not pass over the arms or rim of the spider, it is unnecessary to protect these with heavy wearing plates. The spider rim is fitted into a recessed flange in the top shell which holds it securely in place and resists strains in every direction. The rim, while not continuous, has tapered wedges between the sections, which construction has the effect of holding the spider much firmer than if the rim were continuous. This construction eliminates the internal strains usually found in continuous-rim spiders. On the under side of the arms there are no pockets whatever in which pieces of rock can catch. The head of the spider is fitted with a removable bushing having a taper fit so as to be removed easily in the event of replacement. Above the spider is placed a dust cap made in two parts; it is necessary to remove only the upper and lighter section of this to inspect the top journal and suspension device. The high arched construction of the spider makes it possible to keep the dust cap at an altitude well above the material being fed to the breaker.



SECTION THROUGH BIWABIK CRUSHING PLANT

Shovels Handle 8-Ton Pieces

Inasmuch as the steam shovels handle pieces of ore weighing up to seven or eight tons, provision was made in the original plans for any pieces that might fall across the receiving opening in such a way as to obstruct the entrance of the material to the crushing throat. During the first season's run, however, there was only one piece which failed to enter properly and this was moved by crowbars to a position where it could be caught by the crusher head and broken.

The main shaft is made of high-grade steel, free from sharp corners, and was hollow-bored, to remove from the center any defects or cracks that might be in the original forging which, if not removed, would tend to creep outward and weaken the shaft. The shaft has been designed to follow the cubic parabola, the curve of uniform strength. That portion of the shaft upon which the head is fitted is of extra large diameter so that the two key seats for holding the head will not weaken it in the least and so that the head may be as light as is consistent with the necessary strength. The head is bored its full length to fit the shaft, is kept from turning by means of two zinc keys and is held down on the shaft by a ring nut.

Suspension Device for Crusher

The patented shaft-suspension device consists of a bushing fitted to the hub of the spider, the upper part of which has a spherical top. Upon this bushing there is mounted a crucible-steel wearing ring, the under side of which is turned spherical to correspond with the upper spherical surface of the spider bushing; the upper side of the wearing ring is flat. The suspension collar, made in two parts and clamped securely to the shaft, rests directly on the upper flat surface of the wearing rings, and is prevented from rotation by two feather keys. During the first season's run, a full and perfect bearing was secured with this type of suspension.

The countershaft is liberal in diameter so as not to deflect under strains. The main pinion is of high-grade cast steel, made to accurate pitch and keyed to the inner end of the countershaft. The teeth of the pinion are made of special

shape so that the strength at the root of the tooth is equal to that of the gear. The outer end of the countershaft is fitted with an outboard bearing which is self-oiling and is mounted on an iron sole plate. The driving pulley, 70x28 in., is of the double-arm type, extremely heavy and made with a clamped hub secured to the shaft with a key; it has a speed of 275 r.p.m. The motor, belting and pulleys are inclosed. The structure over the motor is of such size as to give free access.

Distinctive Features of Crusher

Other features of the design are of interest in explaining the dependence to be placed upon a breaker of this description, for the extremely heavy service at the Biwabik mine, and may be summarized as follows: The top shell is made unusually heavy and has a recessed flange at the top to receive the spider. The joint between the top and bottom shell is a tapered fit and both the top and bottom flange are of heavy construction reinforced by wide ribs. The concaves are made sectional, each in four parts, so that it is possible to replace any single section without renewing the other three. They are supported at the bottom by an iron, sectional, removable ring, and extend to the upper edge of the top shell. They are not covered in any way by the spider rim. The company is able to replace these concaves whenever necessary without disturbing the spider.

The bottom shell is of close-grained cast iron of extra heavy construction. The diaphragm and inner sides of the shell are lined with removable hard-iron wearing plates. The spout, which is strongly bolted to the mouth of the breaker is of hard cast iron; the bottom and two sides are separate and bolted together so that either of these pieces may be replaced when necessary. There is a manhole in the side of the shell so that the gears may be easily lubricated while the machine is in operation.

Complete System of Oil Circulation

The bottom plate is of heavy construction and has a tapered joint between it and the bottom shell. Large oil passages are cast in the hub for the rapid and free circulation of oil for the eccentric bearing. Arrangements are also provided for draining oil chambers and for conducting overflow oil to receptacles. The plate also has a removable bushing. The eccentric is made of a high-quality semisteel with extra large bearings babbitted their full diameter on both the inside and outside. The gear is made of semisteel and is riveted to the eccentric.

Oil circulation is induced by capillary attraction for both the eccentric and the main-shaft journals. Large oil holes are cast in the top of the eccentric to allow the oil, which rises from the main shaft journal, to flow through them back to the reservoir underneath the shaft. An oil pump was furnished with the breaker to force fresh oil into the passages when required; it has not been found necessary, however, to use this, as the dust cap, above mentioned, can be lifted and oil poured in through the hollow shaft.

Handling the Crushed Ore

Shipment of the ore, as crushed, is made to Two Harbors, Minn., for transfer to lake carriers, in standard hopper-bottom dump cars of the Duluth & Iron Range railroad; these cars include those of the Summer patent type, manufactured by the Standard Steel Car Company, Hammond, Ind. For service on its property, the mining company has six locomotives, two of which are Baldwins and four from the Pittsburg Locomotive Works.

Biwabik Crushing Plant

One secret of the success in the management of this property has been in keeping the equipment not only up to date, but also in a high state of operating efficiency; for that purpose unusually complete machine and forge shops have been provided. These include a Lodge & Shipley engine lathe, Van Wyck speed lathe, Cincinnati planer, Bickford drill, Acme threader and cutter, Quincy hack saw, Buffalo Forge blower and Morgan Engineering Company hammer. All of the tools are driven by shafting and belting from an Ideal engine. In the power plant there are installed four Northwestern 72-in.x18-ft. tubular boilers, 150 h.p. each, which are operated at 100 lb. pressure. The feed pump is a 7½x5x6-in. Fairbanks, Morse & Co. pump, outside packed and brass fitted.

Screened lump coal is used as it is believed that better economy is obtained than from run-of-mine fuel, ordinarily purchased by companies similarly situated; the same coal is used for the locomotive and steam shovels. At the power plant it is brought in on a raised track and delivered to bins which discharge in front of the furnace doors. For the locomotives and shovels there are elevated coaling bins of standard railroad construction.

Electrical Installations

The main generating unit, from which electric power is supplied to the ore-crushing plant, consists of an Allis-Chalmers 22x36-in. simple engine, direct coupled to a 300-kw. 3-phase, 60-cycle alternator, the current being generated and distributed to the motors at 2300 volts. A direct-current type K generator is used for excitation. The switchboard and protective apparatus, furnished by the same company, are complete, including lightning arresters, and Wagner instruments were used. The company also lights the village of Biwabik and furnishes its water supply from a 120-kw. generating unit and an 800-gal. pump, separately installed, which have no connection with the operation of the mine. For supplying air to the drills there is an Ingersoll-Rand compressor, with steam cylinders 20x14x16 in., and an 18x11x16 in. air cylinder.

In every respect the equipment has been made as complete as experience can suggest, and, operating economy has been given the same careful attention that obtains at modern blast-furnace plants or steel mills.

Humboldt County, Nevada

In a review of some of the mining districts of Humboldt county, Nevada, F. L. Ransome discusses (Bull. 414, U. S. Geol. Surv.) the geology, mineralogy and mining operations of the region. His conclusion is that "the southern portion of Humboldt county is part of a metallogenetic province characterized chiefly by the prevalence of antimonial ores of silver with numerous and widely scattered deposits of stibnite and cinnabar. There are in addition some deposits of gold-silver, copper and nickel-cobalt ores. Ore deposition probably began immediately after the intrusion of the Triassic and Jurassic sediments in late Mesozoic time by a magma of generally granodioritic composition, comparable with that which invaded the rocks of the Sierra Nevada at the same period, and continued into the Tertiary. The known Tertiary deposits are essentially gold-silver ores and copper ores, but it is possible that some of the other types are also Tertiary."

Problems on the Strike

By Josiah Bond*

Peculiar irregularities in the strike of some orebodies caused the discoverers difficulty in properly staking claims.

*Mining engineer, Patagonia, Ariz.

When veins run straight and regular, where exposed at the outcrop, it is not difficult to lay out a claim so that it covers the apex and substantially complies with the law, but it often happens that the vein does not outcrop sufficiently well to show its true course, and much must be taken for granted in laying out the claims. This, I think, is the more usual case. In the old days such a claim could be patented without any difficulty, but under the latest rule of the land department, the claimant must describe the vein and its course with some certainty, and these rules may cause considerable hardship on the applicant for patent. Then, again, the vein may outcrop in such a course as to make it hard to stake a claim so that it will comply with the law and secure for the claimant the land he wants and really should have. The instances herein described will illustrate this point and may prove of interest as illustrating some of the trials of the prospector.

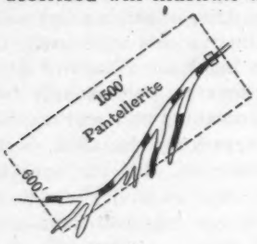


FIG. 1.

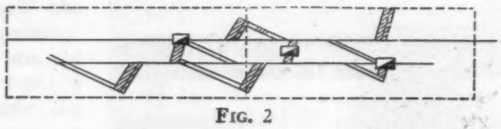
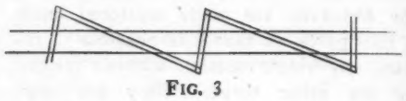


FIG. 2.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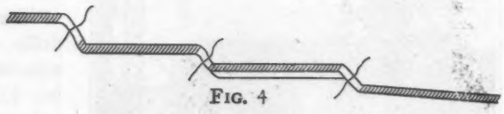


FIG. 4.

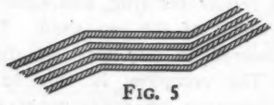


FIG. 5.

FIG. 6.

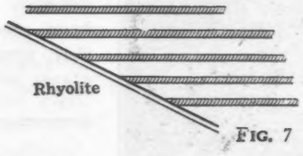


FIG. 7.

FIG. 8.

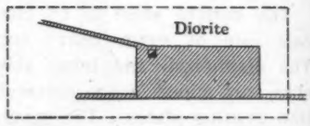


FIG. 9.

FIG. 10.

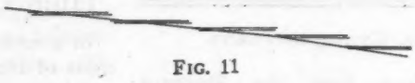


FIG. 11.

FIG. 12.

FIG. 13.

FIG. 14.

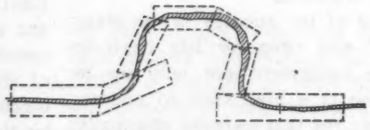


FIG. 15.

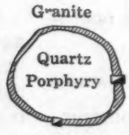


FIG. 16.

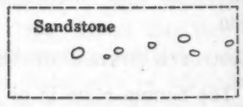


FIG. 17.

The Engineering & Mining Journal

TYPES OF IRREGULAR ORE OCCURRENCE ALONG THE STRIKE OF VEINS

A Torsion Vein

The vein shown in Fig. 1 is perhaps an extreme example of a case that in a more limited degree is often found. The claim was laid out in a northeast and southwest course as an extension to another claim, through which the vein seemed to have this course. Development by various owners, together with the exposed outcrops, shows the vein to have the course as mapped in the illustration in which discovered ore is indicated by shading. Evidently, this vein, with its branches, has been opened by a great torsional movement. All the prospectors in the neighborhood predict great things of this vein at depth, but are shy about patenting it. The development up to date consists of shallow pits, the deepest of which is about 40 ft. The northwest side of the vein is regular enough and is thought to be the foot wall, although this is not yet proved conclusively.

In Fig. 2 there is represented an extremely confusing case. As now laid out, this deposit is covered by two claims. It was formerly covered by claims running in various ways. The shafts are indicated and the shaded areas show ore now known. The rock between the two heavy lines is quartz porphyry; that on either side is intermediate between a diorite and a gabbro. The vein is copper-silver ore, mostly carbonate near the surface, with sulphides showing at about 40 ft. The ore that has been shipped assayed 15 per cent. copper and 55 oz. silver. Some of the veins outlined are fairly exposed naturally, and some were delineated by work, mostly trenching. The porphyry is now supposed to be a dike. After this was intruded, the vein system was formed and later the dike as a whole was faulted relative to other rock; such, at least, is the present theory held by the owner. If he is right, the original vein system was as shown in Fig. 3 and was merely a zig-zag vein. This theory is considerably strengthened by the fact that a zig-zag vein was found in the vicinity which had not been broken by faults and which showed many features similar to this one. The greatest point of similarity is that the cross veins are from four to six feet wide and are always ore bearing, while the lengthwise veins are never more than two feet, generally about one foot wide, and carry ore, as far as is known, in only one place. This dike has an average width of 100 ft., 115 ft. being the greatest width, but

as a whole it is quite regular. It is probable that at the time of faulting the walls moved slightly in reference to each other, besides the movement of the dike, or possibly there may have been two movements, one on each wall of the dike.

A Terraced Vein

The case of the Veta Grande, Fig. 4, is like the last but on a larger scale, the diagonal part of the vein being short compared to the other. This vein is believed to be more than 4 miles long; it has been opened in many places, and copper ore has been shipped from it. There is much iron associated with the copper, especially at the eastern end. The iron is mostly hematite aside from that in the chalcopyrite. The long vein is wide, in places more than 100 ft., while the diagonals are narrow and barren. Each of these diagonal veins is cut by a cañon at about the center in each case, while the main veins usually are in hills. The surface rock, as far as determined, is diorite. The decomposed ore on the surface is rich in silver, while the sulphide ore carries only a little silver, five or six ounces, and $2 or $3 in gold. The diagonal veins are never more than three feet in width and in places not over six inches. The diagonal veins in the figure are about a quarter of a mile long.

The Society Vein

Another occurrence probably due to the same causes is exemplified in a series of veins parallel to one another and close together on the Jersey Girl group. The Mexican term for these is *socias,* and I have called them a society vein; they are quite common in the Southwest, a society of four or five veins running along together for long distances, sometimes miles. While the society occurrence is quite common, it is usually one of the most regular of vein systems. In the case shown in Fig. 5, the vein crosses a small hill, making a sharp angle on each side. The rock is dacite breccia. The society vein is generally a good silver carrier, mostly at the surface; for that reason little is known of them in depth, but in the Apache vein, the structure persists to 400 ft., and in numerous other examples to 250 and 300 ft. We have theorized that in the denser rocks below, these veins should unite into one good strong vein.

A little difference in occurrence is illustrated by the Toluachi vein, shown in Fig. 6. This vein is in dacite, but the turn in the vein, instead of being at a sharp angle, resembling the running together of joints in the rock, is a perfect reverse curve, while if this curve were eliminated, the vein would be perfectly straight. In this case the curve is barren, being pure quartz or other form of silica. About 20 ft. to each side of this curve there was found, on the surface, some rich ore with a copper carrier; the vein has not been sufficiently developed to tell its future; the indications are that good ore will be found at depth near the curve.

A Superabundance

A number of veins are found on Laura hill in the Santa Rita mountains which terminate in a diagonal vein supposed to be a fault plane. These do not form a society vein but are 75 to 100 ft. apart, roughly parallel, and one or two are of merit as ore producers. The country rock is some form of rhyolite. These veins, shown in Fig. 7, are large and offer a disconcerting abundance of opportunity to do work. The diagonal vein is rich in chlorides in one or two places on the surface. What little work was done on it was disappointing in results, there being found about five feet of low-grade sugary quartz, but at the junctions of the veins with the diagonal there are also found large masses of barite, one 4-ft. cube having been broken out. It, however, seems to be associated with the straight vein and not with the diagonal. The rhyolite has been assayed frequently, generally showing a little silver.

In a certain mass of grandiorite there are found more than 50 veinlets crossing the bottom of Bond cañon in the Santa Ritas, in a distance of 100 ft., as shown in Fig. 8. The veinlets are from a quarter to two inches wide, and prospecting has failed to find a place on the strike where they unite to make a long, larger vein. It is possible, however, that this whole 100 ft. might be of value if sent to a mill, as many of the veinlets consist of pure quartz. To aggravate the case, one veinlet of two inches may carry solid galena while the next one consists of pure chalcopyrite, and still another may contain but zinc blende, while others may contain all these minerals mixed. This bears no relation to a stockwork, the veins being as independent as if they were six feet wide and 100 ft. apart. Some more work is needed to demonstrate whether this is a commercial body of ore. In the absence of a mill to treat the ore, the work will be done slowly.

A Block

In Fig. 9 is shown the surface appearance of a vein on the Otter group in the Santa Ritas. The rock is diorite and the ore as marked in the figure is found mostly in a parallelogram about 200 ft. wide and 650 ft. long. From this body a vein from three to four feet wide of the same general character runs out at each end, while from the northwest corner of the large orebody runs another smaller vein at a small angle to the strike of the others. This seems to be similar to the United Verde orebody in shape, but it is not so large. The outcrop of the large body is principally iron oxide, a gossan which assays 3½ per cent. copper with some silver and gold, and is substantially the same in all the shallow work done. If this body would hold its shape in depth, it would certainly produce a large quantity of ore, and if the copper content should increase a little at depth, it would be a good mine. There is a chance to drive a tunnel 500 ft. below the surface, and this the owner intends to do.

In Fig. 10 is shown the surface of a vein on the Cobre group in the Santa Ritas. This does not seem so clearly to be the result of twisting but may be an intersection of veins running at various angles, or again may be simply the ends of fissures disconnected from other fissures on the same general strike and caused by the same set of movements. Influenced by the structure of the rock, these fissures may not have been so easy to form in one long fissure as in many short ones, the general strike of which is at a small angle with the strike of each individual fissure, as shown in Fig. 11, wherein the heavy lines show the fissures as actually formed, while the dotted line is the strike of the whole system. This is noted in the later volcanics of the Southwest as a rather common occurrence. It might be considered as the extreme case of such systems as that shown in Fig. 4, there being in this case no connection between the members of the system. There are some reasons for believing that this structure might persist to considerable depth.

A Branch Vein

In Fig. 12 is shown a type of another not uncommon occurrence in the Southwest. This consists of a branch vein leaving the main vein at a good angle and returning thereto within a short distance. It is noteworthy that in many cases the branch vein is stronger than the straight one and frequently carries the best ore. In the above case, as far as the surface goes, the branch has much the best of it in breadth and value of ore. This naturally leads to the supposition that the curved vein is really the course of the main fracture, the straight vein being merely an incidental and subordinate result of the movement. From the prospector's point of view these are horses in the vein, of which in fact this occurrence may be taken as only a colossal example unfortunate as offering two apparently equal chances for ore, one of which is likely to be much better than the other. From my own experience, I recommend following the curved branch; many experienced prospectors believe curves are lucky anyhow.

A Swelling Vein

In Fig. 13 is shown a vein structure that the prospector likes. This example is from the Calcite claim, the ore being a silver ore with a copper carrier,

the gangue being mostly calcite and other carbonates. Here the vein, from four feet wide in its extension, widens out into a deposit 300 ft. or more in width, with one wall dipping off so as to enlarge the vein at depth. The surface copper occurs as carbonate and some silver chloride has been found, but a few feet from the surface the silver, except a little native silver, is found as carbonate in very small crystals. The ore is blue or bluish yellow. However, the silver may be associated with the copper as a compound carbonate; it may be microscopic argentite, or even native silver mixed with an impure copper carbonate; this point is not yet definitely settled and authorities differ. This occurrence of a blue ore running high in silver is common in the arid country, and the common belief is that the bluer, the more silver; hence the term, blue-silver-ore. Such widening of the vein as found on this claim leads to bonanzas when the ore is rich or has rich spots.

It sometimes takes a few years for a prospector to learn the location of his vein in its extension from its original location. Fig. 14 shows a claim which was originally located in 1858. Various relocations have been made, from time to time, and considerable work has been done, especially near the surface. The claim is now known as the Buena Vista and careful prospecting has convinced the owner that the vein lies as shown in the figure. If there are any connecting veins they have escaped detection to this time, and if this is the true location of the vein it presents a problem to lay out the work so as to get the best results at the least expenditure. It is possible that this vein may be regular enough in depth, the dislocation having been caused by slips. Deep work on this claim will be awaited with much interest by those familiar with the case.

A Horseshoe Vein

In Fig. 15 is represented a quartz vein in the San Juan country; the original discovery was made on the straight vein and claimed as the Poughkeepsie. Some good ore being found, other prospectors sought the extension and it was soon demonstrated that the vein made a horseshoe curve about three-fourths of a mile across. The vein was about 20 ft. wide and one could walk around the whole curve on the outcrop. From the last I heard of this, there had been no deep work done, and one of the speculations was whether this curve may not have been the upper edge of a funnel-shaped orebody which came to a point at some not great depth, at which point the vein would be regular enough. If this should prove to be the case, it would show that the vein was probably formed in this shape when passing from one rock to another, the upper rock having a spherical structure which influenced the course of the vein. This vein was known to be several miles long, I was told.

In Fig. 16 is represented a vein which carries good copper and gold ore. The vein is from three to six feet wide and as far as opened is all pay ore. The last claim I knew on it was called the Gold Circle. The porphyry dike or pipe is about 500 ft. across, and there is no work to show how far this peculiar formation persists at depth, the deepest pit being about 40 ft., which is nearly vertical and follows the ore. It is easy enough to cover this deposit with one claim, but how should it be done most correctly? This occurrence is found in the Santa Rita mountains, which, as Doctor Blake used to say, consist of volcanic ejectamenta in which any known rock is likely to be found and consequently most any vein formation. The rocks, many on the surface at least, are now found in a brecciated condition, which seems to be conducive to irregular veins.

Pipes

In northeastern New Mexico on the Dry Cimmaron river I saw a still more curious occurrence of ore, of which I have seen nothing in the literature of ore deposits. The formation there was red beds imposed unconformably on much older quartzite. The quartzite was threaded by some small veins where it was exposed and also contained irregular concentrations or segregations of copper ore which were frequently of considerable size and generally high grade. Little chunks of copper oxide or black copper sulphide were also to be seen over a certain horizon, which, if my memory serves me right, was near the top of the formation. The prospectors thought this quartzite was Cambrian. This itself was unusual, but in the beds above coarse sandstones, there were numerous little pipes of ore, pure chalcocite, going to depths of 50 ft. at least. These pipes might be five or six feet across but more often two to four feet, circular and sometimes filled with pure ore. From my notes I take Fig. 17, but I have no memorandum of the name of the claim or the place. I have set out these instances of irregularity more as a matter of interest to other prospectors, in hopes, too, that they may be induced to describe irregularities observed by them.

The production of silver and copper in Michigan in 1910, according to statistics of the U. S. Geological Survey, was as follows: Silver, 330,500 oz.; copper, 222,683,461 pounds.

Mints and Assay Offices

Washington Correspondence

Director of the Mint George E. Roberts has determined to make another effort to get Congress to abolish the assay offices throughout the country. Mr. Roberts thinks that there is no longer any service for these offices and that they merely help some large mining concerns to economize on the transportation of metal. As for the mints he does not intend to recommend any change but he will suggest the continued operation of the three large establishments at San Francisco, Denver and Philadelphia. He thinks the New York assay office is enough to do all of the work that should properly come to an institution of that kind in the natural course of business. Mr. Roberts is disposed to inform Congress plainly that the ideal situation would be found if there were one mint and one assay office, both situated at New York, but he recognizes that so drastic a change would be out of the question at present. Last year there was strenuous resistance in those parts of the country where the assay offices were situated to the adoption of any change in existing methods. Some minor economies were effected, although nothing very extensive. This year Congress will be told that the cost of operating the offices is not warranted, since they no longer assist prospectors but are serviceable only to the large mining corporations already referred to. The subject will go to the appropriations committee in connection with the revised estimates for the Bureau of the Mint. The changes recommended are expected to get some support from the fact that they are in line with the general policy of economy and efficiency of which so much has been said. This will be the first year in which the appropriation bill has been formulated by a Democratic committee.

Power for Michigan Mines

Negaunee Correspondence

Considerable attention is being paid to the use of water power for iron mines in Michigan. The Sturgeon Falls plant of the Penn Iron Mining Company, on the Menominee river below Iron mountain, is estimated to pay for itself in eight years by the saving in power furnished to the mines of the company. The Cleveland-Cliffs company is spending approximately $1,000,000 in harnessing the Carp river to furnish power for its extensive mining operations on the Marquette and Swanzy ranges. The powerhouse is situated near Mount Mesnard, two miles south of the city of Marquette. The water is conveyed about four miles in steel and wooden pipe and has a head of several hundred feet at the powerhouse.

Coal Land Legislation for the West

By George Otis Smith*

Present coal-land law inadequate because maximum holdings are too limited. Leasing system is advocated as best method of developing coal lands of the West.

*Director of the U. S. Geological Survey, Washington, D. C.

NOTE—Abstract of an address before the American Mining Congress, Chicago, Oct. 27, 1911.

West of the 100th meridian lies the nation's greatest coal reserve, estimated at more than a million million tons of anthracite, bituminous and subbituminous coal, and from 60 to 85 per cent. of this tonnage is owned by the United States. This fuel reserve is the key to the present and future development of the Rocky Mountain region. Utilization of the water-power resources will be an important factor locally, and for several decades fuel oil may be expected to affect the industrial situation, but so far as we can now foresee coal must be regarded as the principal future source of power.

The West needs and has a right to demand full opportunity for development, but that does not include the right to inflict an unearned speculative tax on the future consumer. The coal operator may justly ask two things: (1) the right to occupy an area sufficiently large for economic operation, and (2) freedom from too great investment risks. Both of these factors are in reality of hardly less interest to the public than to the operator, for upon them depends in the last analysis much that determines prices and concerns general welfare. The public should also demand that no right to the public coal land shall be granted except for present use. Actual development must be made the first condition of occupancy of any part of what now remains of the public domain.

Is Our Coal Law Adequate?

The large holdings of coal land in the West legitimately acquired through railroad grants, by coal companies through dummy entrymen, and by purchase of agricultural entries as well as those patented to the States as nonmineral lands, together constitute a supply of coal land that has practically met the demand. Up to the present time the acquisition of the coal land in the public domain has been largely accomplished without recourse to the coal-land law, so that the question becomes opportune, Is the present coal-land law adequate to meet present and future needs?

This law, by its provision for the valuation of coal lands at an adequate price, makes possible a selling price that may promote development and at the same time prevent monopolization and discourage speculative holding. The purchaser instead of paying a flat rate per acre actually buys the coal by the ton at prices graded according to the quality and the character of the coal. In the four years following the adoption of the policy of classifying and valuing the coal lands the sales have increased 12½ per cent. in acreage and 36 per cent. in value, as compared with the four years preceding, and this in spite of the fact that the four years since July 1, 1907, have included a period of industrial depression and slow recovery as contrasted with the preceding period of boom conditions. So far as its provision for pricing is concerned, the present law appears to be as satisfactory as a sale law can be.

In one serious respect, however, the present law is absurdly out of accord with good mining practice, in that it restricts legal purchases to a maximum of 160 acres for an individual and of 640 acres for an association. The fixed charges of a modern coal mine so equipped as to safeguard life and property and to secure maximum recovery are too high to be assessed against the tonnage of so small a tract. The homestead law expresses the spirit of American institutions in that it has encouraged every citizen to own a home, but there is neither sentiment nor sense in a proposition to sell at a low price 160 acres of coal land to an individual—every citizen does not need to own a coal mine.

The Leasing Alternative

The difficulties involved in the administration of the present law suggest the wisdom of considering the other method of disposition, namely, a leasing system. As Secretary Fisher has stated, "It may well be that a liberal but wisely protected leasing law would be found to promote development more vigorously than any system of outright purchase."

The greatest advantage of the leasing system, both to the operator and to the public, is relief from the capital outlay now required in the acquisition of the large acreage absolutely necessary for a modern mine. This argument advanced against the present policy of valuing the public coal lands at even conservative prices thus becomes an argument for a leasehold law.

The objections made to a leasing system are: (1) that the Eastern coal lands were disposed of in fee and that the West deserves the same treatment; and (2) that the natural resources of the West should not be made a source of profit to relieve the Eastern taxpayer. The large tonnage of coal now mined under lease meets the objection to direct Government leasing, and as regards the argument of reserving the Western resources for the West, it should be noted that under the present system of sale the proceeds from the coal lands go directly into Western development through the reclamation fund, and it is proper to expect that any leasing law would make similar disposition of the proceeds.

Other objections express a fear that the cost of coal to the consumer would be increased; but the royalty paid into the United States treasury can be no greater a tax upon the consumer than the royalty paid to the State of Colorado or to a railroad land company. The average price of bituminous coal at the mine in the United States last year was $1.12, which usually includes a royalty to private owners or an equivalent interest charge, either of which would probably be greater than any Government royalty.

If we consider the lease as contrasted with sale outright to the coal operator, the reduction in capital necessary for original investment and the elimination of many of the risks in such investment must result in reducing cost of operation to the mine owner and thus make possible a correspondingly lower price of coal to the consumer.

Experience of New Zealand

The other objection to the lease system is that based upon fears of expensive Federal management and of inefficient administration or even maladministration. If we look out across the Pacific, we discover that a government leasing system for coal lands is not a theory but an actual working fact. The Anglo-Saxon peoples of the Australasian states have found the leasing system not only practicable, but indeed preferable to the sale of coal lands. In New Zealand, where for 30 years the laws have permitted to the operator a choice of either sale or lease of public mineral lands, a conclusive argument for the leasing system is given in the latest statistics of mineral production, which show that approximately 90 per cent. of the total mineral product of that country was mined under leasehold. If our trans-Pacific neighbors can administer a lease law so satisfactorily and if the mine operators in New Zealand prefer operation under leasehold, will a similar system be fraught with either danger or failure in the United States?

All the West needs is, first, opportunity for the coal industry to develop as fast as the market justifies expansion, and with the least possible risks; and, second, opportunity for the public to procure its coal at prices based on a minimum cost of production, without any addition of unearned and undue tribute to private landlords who desire to speculate on the future needs of the consumer. These ends can be best attained by legislation establishing a Federal leasing system for the coal lands of the public domain.

Concrete Work at New Belmont Mill

By C. B. Clyne*

A brief description of the methods employed by the contractor in mixing and pouring concrete for the retaining walls and foundations of the new mill for the Tonopah-Belmont Development Company is given below.

The mill is on the side of a hill sloping toward the east and at about 15 deg. It is in six terraces with foundation and retaining walls between each two terraces and with curtain walls at the ends. The north side is 258 ft. long, the west end is 154 ft. long, the east end is 280 ft. long, and the south side is 128 ft. long at the wider part and 130 ft. long for the remainder. All floors are of concrete, which brings the total amount for the entire mill to approximately 4000 cu.yd. To handle such an amount of material a carefully designed plant was needed and it was decided to use the so called "G.-Y." system, a patented system controlled by the Concrete Appliance Company of Los Angeles. This system has been developed within the last year from the standard practice of a large building contractor and is already being used under a license by a half dozen other contracting firms.

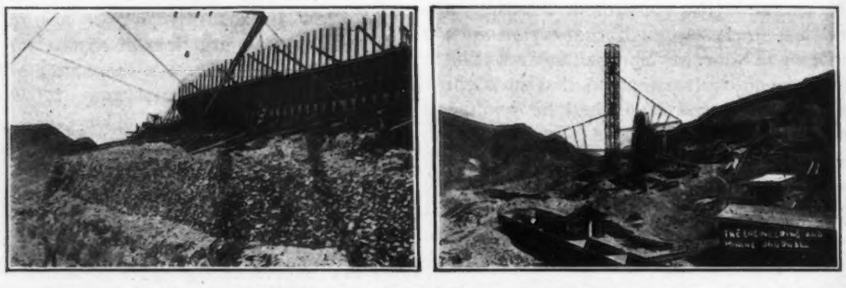
The equipment for crushing rock, moving sand and cement, mixing the aggregate and distributing it to the forms consists of the following: A No. 4 gyratory crusher fitted with manganese-steel head and concaves driven by a 20-h.p. motor, a chain-bucket elevator 46 ft. long with 7x13-in. buckets receiving the crushed rock and delivering it to the rock bins which are 14x32 ft. by 12 ft. high. The crusher is fed with rock excavated from the site by means of 18-cu. ft., side-dump cradle cars. A cement storehouse 16x40 ft. and a sand platform of the same size and with 3-ft. sides were built along the railroad spur close to the north side of the millsite and near the lower end. For carrying sand and cement up the hill to the mixer, 12-ft. end-dump cars fitted with combination drawbars and bumpers are used.

*374 Pacific Electric building, Los Angeles, Cal.

The situation of the tower was carefully selected with a view to the most economical feeding of the mixer. It is 8 ft. square and 96 ft. high and has a boom on the upper side 65 ft. long and 28 ft. from the ground, and a 75-ft. boom on the lower side 12 ft. from the bottom. Because of the extremely high winds which prevail in Tonopah unusual precautions were taken in guying the tower. Each boom carries the lower end of a trough, the upper ends being supported at tower pans placed respectively 80 ft. and 48 ft. from the bottom of the tower. A 44-ft. mast was erected near the southeast corner of the millsite and connected with the main tower by a trough 197 ft. long. The mast was fitted with a 48-ft. boom and the entire structure was free to revolve in a complete circle. The booms on the upper tower were limited in their travel to less than a semi-circle. All troughs were made of No. 16-gage galvanized steel, bent into a round-bottom section 8 in. wide by 10 in. deep. The upper edges were stiffened by 1¼-in. angles, and the trough was trussed by ⅜-in. cables stretched over wrought-iron struts. Free ends consisting of riveted pipe in a trussed frame are attached to the ends of the booms and can be moved in any direction. This feature together with the movement of the booms gives complete flexibility. The mixer is a ½-yd. batch mixer placed at the foot of the tower and in such a position that it discharges into a ½-yd. square skip traveling on flat rails carried on the face of the tower. A 20-h.p. motor furnishes power for the mixer and for a drum hoist which raises and lowers the skip.

In operation the ½-yd. cars are filled with sand to the required amount, then trammed into the cement shed and the proper amount of cement added from the measuring box. The cars are then pulled by means of an electric hoist to the mixer floor, trammed under the rock bin, where the crushed rock is added and dumped into the mixer. Each carload makes a batch and when sufficiently mixed the batch is discharged into the skip, hoisted up the tower and dumped automatically into the hopper which is being used. The discharge from the hopper into the trough is under control of an operator stationed there, who receives his signals from the foreman.

The amount of concrete handled in a day was generally limited by the form building, but on uninterrupted runs as much as 180 yd. was poured in a day, which places the capacity of the system far in excess of any results attainable by the former and usual method of making concrete. The mixture was necessarily wetter than was considered good practice for tamped concrete, but when flowing to the most remote parts of the work no classification took place, and the complete filling of the forms was attested by the smooth, clean surface of the finished concrete.



Pouring a Concrete Wall for the New Belmont Mill and the Tower from Which the Concrete Is Poured

Concentrating of Monazite

F. Price, discussing the subject of monazite treatment, says (*Oestr. Zeit. f. B. u. H*) that the main difficulty to be overcome in separating the monazite from the minerals which accompany it is found in the fineness of the material after it issues from the washing process. A great number of samples, taken from about 200 different deposits, were examined, the result being that only about 11 per cent. consisted of grains of more than 1 mm. diameter.

A thorough investigation as to the magnetic excitability of all the important accompanying minerals showed the possibility of separation by a magnetic process. Monazite can also be eliminated by treating the sand with muriatic acid, the accompanying minerals being nearly all insoluble in such a solution. The pneumatic process did not prove successful. Good results were obtained by a process invented by Mr. Price, which is based upon the difference in the friction angles, the monazite grains being round, while the grains of the accompanying minerals are angular. According to this process, the material is placed on a suitably constructed inclined plane, interrupted by cross channels. The elimination of the monazite can then be accomplished, provided there is an absence of iron minerals. The Witt friction process, which is based upon the difference of the friability of the different minerals, can be used only after previous magnetic separation.

Mining and Metallurgical Patents

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

A Classified List of New Inventions

GOLD AND SILVER

AMALGAMATOR. Charles F. Davis, Tallapoosa, Ga., assignor of one-eighth to John N. Jones, and one-eighth to Fred D. Jones, Woodward, Ala. (U. S. No. 1,005,105; Oct. 3, 1911.)

CHLORINATION—Process of Recovering Fine Gold. James H. Ailing, Columbia, Cal., assignor, by direct and mesne assignments, to Security and Holding Company, San Francisco, Cal. (U. S. No. 13,307, reissue; Nov. 7, 1911.)

CONCENTRATOR—Dry-Process Gold Machine. David M. Owings and William M. Osborn, Canton, Okla., assignors of one-half to Allen C. Frazier and Edward C. Frazier, Canton, Okla. (U. S. No. 1,006,267; Oct. 17, 1911.)

CONCENTRATOR AND AMALGAMATOR. Richard Truste Carter, Carlton, Victoria, Australia. (U. S. No. 1,006,433; Oct. 17, 1911.)

CYANIDING—Apparatus for Precipitation Treatment of Liquid. Frank Ondra, Ferreira, Johannesburg, Transvaal. (U. S. No. 1,003,781; Sept. 12, 1911.)

DREDGING—Spud for Gold Dredges. Samuel B. Harding, Waukesha, Wis., assignor to Modern Steel Structural Company. (U. S. No. 1,006,845; Oct. 24, 1911.)

GOLD-SAVING APPARATUS. Thomas Gilbert, Oakland, Cal. (U. S. No. 1,006,649; Oct. 24, 1911.)

RIFFLE for Amalgamation of Gold. James Oliver Kinney, Grand Junction, Colo. (U. S. No. 1,006,953; Oct. 24, 1911.)

IRON AND STEEL

BLAST FURNACES—Tuyere Sight for Blast Furnaces. Johnson V. Symons, Westmont, Penn. (U. S. No. 1,005,359; Oct. 10, 1911.)

CHARGING — Improvements in Charging Apparatus More Especially Intended for Charging Open-Hearth Furnaces. B. W. Head, London, Eng. (Brit. No. 14,245 of 1911.)

DRYING AIR—Apparatus for Drying Air by Refrigeration. James Gayley, New York, N. Y. (U. S. No. 1,002,576; Sept. 12, 1911.)

FERRO METALS—Method of Treating Ferro Metals. Auguste J. Rossi, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Company, New York, N. Y. (U. S. No. 1,003,805; Sept. 19, 1911.)

REFINING—Electrolytic Method of Refining Iron. Alexander S. Ramage, Buffalo, N. Y. (U. S. No. 1,007,388; Oct. 31, 1911.)

SAFETY GATE for Pouring Spout. Max M. Suppes, Elyria, Ohio. (U. S. No. 1,002,700; Oct. 24, 1911.)

SEPARATION—Gravity Liquid Separation of Certain Iron Ores. Francis I. du Pont, Wilmington, Del. (U. S. No. 1,002,865; Sept. 12, 1911.)

SINTERING — Rotary Sintering Furnace. Hartley C. Wolle, Johnstown, Penn. (U. S. No. 1,005,396; Oct. 10, 1911.)

LEAD, ZINC AND OTHER METALS

ALUMINA—Process of Making Pure Alumina. Ottokar Serpek, Paris, France, assignor to Société Generale des Nitrures, Paris, France. (U. S. No. 1,007,495; Oct. 31, 1911.)

LEAD REFINING—Process of Refining Lead and Lead Alloys. Leland E. Wemple, St. Louis, Mo., assignor of one-half to Hoyt Metal Company, St. Louis, Mo. (U. S. No. 1,006,323; Oct. 17, 1911.)

ZINC—Improved Means Applicable for Use in the Separation and Recovery of Zinc from Ores and Other Metalliferous Substances. Thomas Huntingdon, Pertusola, Italy. (Brit. No. 20,296 of 1910.)

ZINC—Manufacture of Oxide of Zinc for Smelting. Ralph Waldo Emerson MacIvor and Woldemar Hommel, London, England, assignors to the Metals Extraction Corporation, Limited, London, England. (U. S. No. 1,007,124; Oct. 31, 1911.)

ZINC—Metallurgy of Zinc. Augustin Leon Jean Queneau, Philadelphia, Penn., assignor to Queneau Electric Zinc Furnace Company, Philadelphia, Penn. (U. S. No. 1,006,877; Oct. 24, 1911.)

ZINC—Metallurgy of Zinc Ores and Compounds. Augustin Leon Jean Queneau, Overbrook, Penn., assignor to Queneau Electric Zinc Furnace Company, Philadelphia, Penn. (U. S. No. 1,006,876; Oct. 24, 1911.)

ZINC—Obtaining Zinc and, or, Copper from Complex Ores or the Like. John R. Williams, Henry W. Bradley and Benjamin Bradley, Sheffield, England. (U. S. No. 1,006,330; Oct. 17, 1911.)

NONMETALLIC MINERALS

EMERY—Method of Treating Emery Ore. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Company, Niagara Falls, N. Y. (U. S. No. 1,002,608; Sept. 5, 1911.)

PHOSPHATE ROCK—Apparatus for Washing and Recovering Fines from Phosphate Rock. Herman D. Ruhm, Mount Pleasant, Tenn., assignor to Ruhm Phosphate Mining Company, Mount Pleasant, Tenn. (U. S. No. 1,002,182; Aug. 29, 1911.)

PHOSPHATE ROCK—Method of Treating Phosphate Rock. Charles N. Meriwether, Trenton, Ky. (U. S. No. 1,002,297; Sept. 5, 1911.)

MINING—GENERAL

DRILL—Core Drill. Coleman Arthur Terry, deceased, New York, N. Y.; Emma J. Terry, administratrix, assignor to Terry Core Drill Company. (U. S. No. 1,006,418; Oct. 17, 1911.)

DRILLING—Dust Collector for Rock Drills. Charles Solomon Wahlstrom, Wallstreet, Colo., assignor of one-fourth to Gustaf Theodore Johnson and one-fourth to Edward Stenson, Denver, Colo. (U. S. No. 1,003,075; Sept. 12, 1911.)

DRILLING—Mine-Drill Jack. Jerry E. Powell, Haywood, W. Va. (U. S. No. 1,001,074; Aug. 22, 1911.)

DRILLING MACHINE. Daniel Shaw Waugh, Denver, Colo., assignor to the Denver Rock Drill and Machinery Company, Denver, Colo. (U. S. No. 1,003,018; Sept. 5, 1911.)

DRILLS—Apparatus for Shaping and Sharpening Rock-Drill Bits. William H. Smyth, Berkeley, Cal. (U. S. No. 1,006,306; Oct. 17, 1911.)

DRILLS—Improvements in and Relating to Hand Supported Percussive Rock Drills and Like Machines. H. Schwarz, Mulheim a Ruhr, Germany. (Brit. No. 22,796 of 1910.)

DRILLS—Improvements in and Relating to the Manipulation of Rock Drills. W. Treckmann, Gelsenkirchen, Germany. (Brit. No. 29,055 of 1910.)

DRILLS—Improvements in or Relating to Drills for Rock-Drilling Machines. E. Tippett, Troyeville, South Africa. (Brit. No. 21,666 of 1910.)

DRILLS—Improvements in or Relating to Hammer Rock Drills, Percussive Hammers and Similar Tools. Albert W. Daw and Zacharias W. Daw, London, Eng. (Brit. No. 2595 of 1911.)

DRILLS—Throttle Valve. Daniel Shaw Waugh, Denver, Colo., assignor to the Denver Rock Drill and Machinery Company, Denver, Colo. (U. S. No. 1,006,514; Oct. 24, 1911.)

HAMMER DRILLS—Improvements in Pressure Fluid Actuated Tools. Ingersoll-Rand Company, New York. (Brit. No. 21,818 of 1910.)

ORE HANDLING—Apparatus for Handling Ore. Charles H. Wright, Cleveland, Ohio, assignor to the Brown Hoisting Machinery Company, Cleveland, Ohio. (U. S. No. 1,007,762; Nov. 7, 1911.)

PROP for Mines. August Winz, Rüttenscheid, near Essen-on-the-Ruhr, Germany. (U. S. No. 1,006,163; Oct. 17, 1911.)

RESPIRATOR—Combined Respirator and Pressure Equalizer. William F. Merryman, Denver, Colo., assignor of one-half to Philip Hoffman, Denver, Colo. (U. S. No. 1,003,935; Sept. 19, 1911.)

ROCK-DRILL EXTRACTOR. Earl K. Smith, Tonopah, Nev. (U. S. No. 1,007,248; Oct. 31, 1911.)

ROCK-DRILL MOUNTING. Edwin M. Mackie and Percival F. Doyle, Franklin, Penn., assignors to Chicago Pneumatic Tool Company, Chicago, Ill. (U. S. No. 1,007,216; Oct. 31, 1911.)

SAFETY APPARATUS—Mine Safety Apparatus. Maturen Gold, Hayward, Okla., and William Arthur Montgomery, Solano, N. M. (U. S. No. 1,005,196; Oct. 10, 1911.)

SAFETY LAMPS — Miner's Safety-Lamp Tester. Fred Benedetti and Andrew Stella, Black Diamond, Wash. (U. S. No. 1,004,348; Sept. 26, 1911.)

SHAFT LINING—Reinforced-Concrete Lining for Mine Shafts and Method of the Manufacture Thereof. Carl Scholz, Chicago, Ill. (U. S. No. 1,006,799; Oct. 24, 1911.)

ORE DRESSING—GENERAL

CLASSIFIER. Charles Hoyle, El Oro, Mexico, and Harry A. Guess, Flat River, Mo. (U. S. No. 1,007,205; Oct. 31, 1911.)

CONCENTRATES—Apparatus for Collecting Concentrates. William F. Deister, Fort Wayne, Ind. (U. S. No. 1,007,074 and 1,007,075; Oct. 31, 1911.)

CONCENTRATION—Improvements in or Relating to the Concentration of Ores. H. H. Greenway, Melbourne, Australia. (Brit. Nos. 21,856 and 12,857 of 1910.)

CONCENTRATOR TABLE. Richard T. Schraubstadter, St. Louis, Mo., assignor of one-eighth to Carlos P. Griffin, San Francisco, Cal. (U. S. No. 1,006,293; Oct. 17, 1911.)

DECANTING APPARATUS. Mark R. Lamb, Milwaukee, Wis., assignor to Allis-Chalmers Company, Milwaukee, Wis. (U. S. No. 1,007,954; Nov. 7, 1911.)

MAGNETIC SEPARATOR for Ores. James B. Etherington, Winthrop, Mass., assignor to Campbell Magnetic Separating Company. (U. S. No. 1,006,835; Oct. 24, 1911.)

SEPARATION—Liquid Gravity Separation of Solids. Francis I. du Pont, Wilmington, Del. (U. S. No. 1,004,815; Oct. 3, 1911.)

SEPARATOR—Dry Separator. Carl Hering, Philadelphia, Penn. (U. S. No. 1,005,971; Oct. 17, 1911.)

METALLURGY—GENERAL

COPPER-NICKEL-IRON ORES — Process of Treating Ores. Franklin R. Carpenter and Arthur Howe Carpenter, Denver, Colo.; Arthur Howe Carpenter, administrator of said Franklin R. Carpenter, deceased, assignor of one-half to Kirby Thomas, New York, N. Y. (U. S. No. 1,006,355; Oct. 17, 1911.)

DESULPHURIZING—Improvements in Desulphurizing Ores or Concentrates. V. Wedge, Ardmore, Penn. (Brit. No. 1535 of 1911.)

ELECTRIC FURNACE. Alois Helfenstein, Vienna, Austria. (U. S. No. 1,000,805; Aug. 15, 1911.)

ELECTRIC SMELTING—Process of Producing Metals and Alloys by Smelting in Electric Furnaces. Ampère Gesellschaft mit Beschrankter Haftung, Berlin, and Erich Muller, Stuttgart, Germany. (Brit. No. 21,603 of 1910.)

REDUCING AND SMELTING—Method or Process for the Reduction and Smelting of Ore and Arrangement Therefor. Filip Tharaldsen, Trondhjem, Norway. (U. S. No. 1,007,990; Nov. 7, 1911.)

REFINING—Arrangement of Electrodes for the Electrolytic Refining of Metals. Friedrich Max Köhler, St. Petersburg, Russia. (U. S. No. 1,005,718; Oct. 10, 1911.)

ROASTING—Improvements in and Relating to Rotary Rabbles for Ore-Roasting Furnaces. J. P. F. Herreshoff, New York, N. Y. (Brit. No. 22,022 of 1910.)

ROASTING—Improvements in or Relating to Processes of Clinkering, Roasting, Calcining or Otherwise Treating Materials. F. W. Yost, Chicago, Ill. (Brit. No. 14,276 of 1910.)

SINTERING—Improved Means Applicable for Use in Sintering Iron and Other Ores and Metalliferous Compounds. Josef Savelsberg, Papenburg-on-the-Ems, Germany. (Brit. No. 20,133 of 1910.)

SLAG—Granulating Slag. Adolphe Seghers, Paris, France, assignor to "Pyrotrass" Société Anonyme pour la Fabrication du Trass Artificial (Breveté) et ses Applications Industrielles, Paris, France. (U. S. No. 1,008,204; Nov. 7, 1911.)

SMELTER FUME—Fume Condenser. Andrew J. Hopper and Henry F. Prindle, Oakland, Cal. (U. S. No. 1,007,356; Oct. 31, 1911.)

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Philip Argall is now in London, and expects to return to Denver, Colo., early in December.

Edward S. Wiard has removed his office from No. 417 to No. 429 Boston building, Denver, Colorado.

President Alderson, of the Colorado School of Mines, and Capt. James T. Smith visited Creede, Colo., last week.

W. H. Aldridge, managing director of the Inspiration Copper Company, has gone to the mine, after a visit in New York.

W. F. Ferrier is the new chairman of the Toronto branch of the Canadian Mining Institute; W. E. H. Carter is secretary.

Joseph E. Chalifour has been appointed chief geographer for the Canadian government, in place of the late R. E. Young.

T. R. Hunt, of Golden, Colo., has been engaged by M. W. La Fayette to superintend the La Fe mine at Guadalupe y Calvo, Mexico.

John W. Kniffin is at Steeple Rock, N. M., supervising the erection of a cyanide mill, which will be put in operation in about three months.

Dr. James Douglas, of New York, has promised $100,000 toward the fund of $1,000,000 which is being raised for McGill University, at Montreal.

W. D. Pearce, of El Paso, Tex., has gone to Cusihuiriachic, Chihuahua, Mexico, to examine the property of the Cusi Consolidated Mining Company.

Victor Rakowsky returned to Duluth, Minn., Nov. 5, from northwestern Ontario, and left Nov. 12 on professional work in the Sudbury district, Ontario.

Desaix B. Myers is engaged in mine-examination work in Calaveras county, California, and expects to return to Los Angeles about the end of November.

O. H. Reinholt, formerly on the Mesabi iron range in Minnesota, later in the Philippines and in California, is now on duty with the Bureau of Mines at Pittsburg.

Pope Yeatman has gone to the Southwest to visit the porphyry mines of that region, after which he will visit Ely and Bingham, returning to New York about the middle of December.

Dr. D. D. Cairnes, of the Canadian Geological Survey, has returned to Ottawa, having been engaged during the summer in geological work in the Yukon in connection with the international boundary survey.

James Ashworth, consulting mining engineer, Vancouver, B. C., late general manager of the Crow's Nest Pass Coal Company, has made an examination of the Head Syndicate's coal property on the south fork of Old Man river, Alberta.

A. P. Scott, who for the past three years has been connected with the Allegheny Steel Company, Pittsburg, as metallurgist, has resigned that position and goes to the Dominion Iron and Steel Company, Sydney, N. S., in the same capacity.

E. T. Bedford has resigned as a director of the Standard Oil Company and as president of the Bedford Oil, the Colonial Oil and Bourne-Scrymser companies. He has been connected with the Standard Oil for 30 years, and now retires from active business.

Abraham Ferriz, chief inspector of explosives in Mexico, represented the Mexican government at the recent National mine-safety demonstration at Pittsburg. Señor Ferriz lately visited the Marianna coal mine, in company with O. H. Reinholt, of the Bureau of Mines.

The firm of Place & Elton, of Oaxaca, Mexico, has been dissolved, A. E. Place having sold his interest to Mr. Elton. Mr. Place has taken a lease and bond on the San José de Gracia mine and mill in Sierra Juarez district, Oaxaca, where he is working on his own account.

E. H. Harrington has resigned as superintendent of the Bunker Hill mine, in Amador county, Cal., owing to ill health. Elisha Hampton, Nevada City, succeeds him. Mr. Hampton was formerly superintendent of the Oneida, the Central Eureka and also of the Goldfield Consolidated.

E. T. Corkill and J. H. Murray, of Toronto, Ont., attended the Mines Safety demonstration at Pittsburg. Other Canadians present were Mr. Tolmie, deputy minister of science, and Inspector Strachan, of British Columbia; J. Hudson, of the Mines Branch at Ottawa, and Mr. MacMahon, of the Dominion Coal Company.

E. R. Buckley has opened an office at 1364 People's Gas building, Chicago, as a consulting mining geologist and engineer. Mr. Buckley spent three years with the Wisconsin Geological Survey, seven years as director of the Missouri Bureau of Geology and Mines, and has just completed four years' professional service as a mining expert.

Silvain Guggenheim has retired from the firm of Altheimer, Speier & Co., Frankfurt-am-Main, Germany, but will remain a silent partner. L. Heidingsfelder enters the concern as active partner. Mr. Heidingsfelder was heretofore a director of the Tellus Actien Gesellschaft, a subsidiary company of Beer, Sondheimer & Company.

OBITUARY

John McMurdy Warner died at Overbrook, Penn., Nov. 11, aged 53 years. He was for many years connected with the iron firm of Rogers, Brown & Co., having charge of the Philadelphia branch. He retired several years ago.

Walter N. Kelly died, Nov. 14, at Phœnix, Ariz., aged 38 years. He was born in San Francisco and had always been a resident of that city. For over 20 years he was with the machinery firm of Messe & Gottfried; he was also connected with the Kelly Transmission Company. He served in the Philippines for a time with the First California regiment, and was in command of the militia in San Francisco during the trying times following the great fire of 1906. He was well known to mining men of the State.

George A. Treadwell died in New York, Nov. 13, at an advanced age. He graduated from Yale and spent several years in Germany. He spent many years prospecting and mining in the Southwest. He claimed to be the discoverer of the copper deposits at Jerome, Ariz. He attracted some attention by a protracted litigation to set aside the reorganization of the United Verde Copper Company, which was finally decided against him. Later he organized the George A. Treadwell Mining Company and the McKinley Mining and Smelting Company, neither of which was successful.

SOCIETIES and TECHNICAL SCHOOLS

Canadian Mining Institute—At the recent meeting of the Toronto Branch at Toronto, Ont., a committee of five was appointed to "investigate the subject of workingmen's compensation with particular reference to workers in mines and allied industries."

Institution of Mining and Metallurgy—At a special general meeting in London, Nov. 23, Dr. James Douglas was to deliver a lecture, to be illustrated by lantern slides, on "The Development of the Copper Queen and the Warren Mining District." The annual dinner of the institution will be held Dec. 15 at the Savoy Hotel, London.

American Society for Testing Materials—At a recent meeting of the executive committee of the American Society for Testing Materials, a resolution was adopted which has been submitted to the members, which provides for holding the next annual meeting prior to April 1, 1912. At the Atlantic City convention a resolution was adopted to hold this meeting in June, but owing to the fact that the sixth congress of the International Association for Testing Materials will be held the following September, in New York City, it has been considered advisable to move forward the annual meeting of the American society.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

San Francisco

Nov. 16—Governor Johnson has refused to incorporate in the call for a special session of the legislature the consideration of a measure for districting the State and levying a special tax to provide funds for the legal protection of oil formations from water infiltration. A petition had been presented to the governor by a committee of oil men, and was given consideration. This matter was presented to the legislature at the session of 1911, with the result that the law of 1909 was allowed to stand. That law provides for the appointment of commissioners in oil-producing counties, to be paid by the counties appointing them, whose duties are such that the evils of infiltration may be cured if the county interested is disposed to foot the bills, which expense in the end must be paid by the oil operator violating the law. In brief, the law provides that the owner of a well must prevent injury to a neighboring well; and that the commissioner is empowered to appoint all necessary agents and assistants to enable him to properly enforce the law. If the defendant shall be convicted of violation, it is provided that in addition to the penalties he shall pay all reasonable and proper costs incident to the investigation. But the oil men who have petitioned the governor to embrace their demands in the call for a special session of the legislature complain that one commissioner is not enough for the large oil-producing counties, and impliedl they admit that the counties are not willing to incur the expense of additional agents and the proper regulation of the matter. There is no doubt that the law of 1909 could be improved by proper amendment, but the hope of the oil counties for a tax levy to lay equally on the farmer and the metal miner and other industrial operators for the regulation and protection of the individual interests of the oil producers will be long deferred, even though it maketh the heart of the oil man sick.

Denver

Nov. 18—Four years having elapsed, it was supposed that the Government would drop the prosecution of the "Lost Bullion" case, but the U. S. Court of Appeals has remanded the case to the lower court, and the defendants will be tried a second time.

The San Juan district has had notice of a great reduction in power-service charges from General Manager Joseph Bailey, of the Telluride Power Transmission Company, which will be a powerful aid in prospecting and developing the mines of the region. For 12-h.p., 24-hour service, the average will be $36 per month for crosscutting and development work, but as soon as this work results in putting the mine on a paying basis from the development of the ore the charges will be raised to the regular schedule, which averages $72 per h.p. In the reduced rate there is little or no profit to the power company, but the rate is offered in order to stimulate the development of the mines of the district.

Denver being an inland city, remote from any possibility of coast attack by sea or land, has been chosen by the Government as the safest storage point for the nation's gold and there is now deposited in the mint of this city $600,000,000 of that noble metal, and it is said that the mints of coast cities have discontinued the coinage of gold. Gold amounting to $93,000 was received a short time ago from a Nevada mining company, which formerly shipped its bullion to San Francisco.

Butte

Nov. 15—Alleging that the merging of the Alice Gold and Silver Company with the Anaconda Copper Mining Company is a conspiracy in restraint of trade, minority stockholders of the Alice company brought suit at Helena Nov. 9 against the Anaconda company, John D. Ryan and others, to have the sale canceled. They ask that the defendant company be restrained from prosecuting an action now pending in Salt Lake for the dissolution of the Alice company, and further that the deed of the Alice company now held by the Anaconda company be redelivered to them in return for the Anaconda stock issued in payment for the property.

At a stockholders' meeting held on Nov. 11, at which a majority of the stock was pooled, William Stewe, Jr., of Butte, was made superintendent of the Hidden Lake property in Deer Lodge county, and sent out to succeed D. T. Robinson, a large individual stockholder, who has been acting superintendent for a month or more. A lease has been granted by the company on one of the claims, of which there are 18 in all, to Grant & McMurdie, with the stipulation that the leasers shall sink a shaft on the property 100 ft. deep and pay the company 25 per cent. of the gross smeltery returns. The claim is at the opposite side of the group from the Gold Bug claim, and it has produced some of the richest ore ever mined by the company. The working force will remain the same as at present, but will be increased after the timbering and repairing now going on are completed. Considerable ore is ready for mining in the Gold Bug, and hauling will be started as soon as the snow-covered wagon road is broken in. During the winter the company will ship the first-class ore to the smeltery and in the spring a mill and cyanide plant will be erected.

Salt Lake City

Nov. 16—The freight reductions secured through the ruling of the Interstate Commerce Commission in the Missouri-Salt Lake case went into effect Nov. 15. This is of wide interest to the State as a whole and will be of benefit to the mining industry. Utah has long needed the lower rates which have been enjoyed by points both east and west. The Commercial Club requested citizens and business men to raise the American colors in honor of the event, which is regarded as one of the most important in the business history of the State. There was a freight-rate celebration and banquet at the Commercial Club on the evening of Nov. 15, at which about 250 members were present. Speeches were made by Gov. William Spry, Stephen H. Love, president of the traffic bureau, and others who were active in the campaign which was begun three years ago. In October, 1908, the board of governors of the Commercial Club appointed a traffic bureau of nine members to look into the rate question, with a view to securing a new and better adjustment. A yearly saving of about $1,000,000 is expected to result.

During the autumn the camps in Big and Little Cottonwood, Salt Lake county, have shown a steady increase in activity and improved conditions are reported. Development will be carried on during the winter at most of the mines, in spite of the severe weather at this high altitude, the highest of any camp in Utah. The Alta Consolidated has recently made two shipments and the Utah Mines Coalition and Cardiff have been maintaining a steady output. The litigation between the Utah Mines Coalition and the City Rocks has been settled out of court. Talk of

a consolidation of some of the properties at Alta still continues.

An addition of a quartering and bucking department has been made to the sampling plant of the International smeltery at Tooele. This is separated from the mill itself and is especially well lighted and ventilated. An electric dryer, pneumatic screens, shakers and sample-mixing machines, which will be driven by electricity, are to be installed. A special room has been arranged for customers who desire to watch their ores being sampled, from which each step in the operation can be seen. A reservoir is being built in Pine cañon, partially of cement, which will have a capacity of about 400,000 gal., and will guard against possible water shortage.

Negaunee, Mich.

Nov. 17—The Raymond Concrete Pile Company has suspended work on the new concrete ore dock being built at Marquette for the Lake Superior & Ishpeming railway but will resume operations in the spring. The Wisconsin Bridge and Iron Company, that has the contract for the steel construction is still working, but will probably be forced to stop by cold weather. The railroad is controlled by the Cleveland-Cliffs Iron Company, and ore shipments are made over its lines from the mines of that company and from the Jones & Laughlin mines. It is reported that the Breitung-Kaufman mines will ship over this railroad next season.

The Foundation Company of New York is sinking two concrete shafts on S. 35, near Cyr, at the southeastern end of the Swanzy range, for the Cleveland-Cliffs Iron Company. The latter company has been doing considerable exploratory work through the thick overburden to determine the southeastern extension of the ore-bearing formation which has been found to widen out in that vicinity. It was on the Swanzy range that the first drop concrete shaft was sunk in the Lake Superior district; this was at the Smith mine of the Cleveland-Cliffs company, where a timber drop shaft was first attempted through 62 ft. of overburden with the water level 4 ft. from surface. This was abandoned and a contract let for a concrete shaft, sunk with compressed air for holding back the water, after it was found that pumping 1000 gal. of water per min. did not lower the water below 12 feet.

It is reported that the Gleason interests of Escanaba have taken an option on the Jackson lands in S. 33-T. 43-R. 35, in the Iron River district, and will explore in that vicinity. This is near Stanley lake, two miles west of the Hiawatha mine close to the Grieg property where the Wickwire company has found ore. Several local men are also exploring in the same section. The Gleasons had some success in exploring north of Iron River at the Davidson mine and have lately done work in the Crystal Falls district south of the Dunn mine of the Corrigan-McKinney company.

Duluth

Nov. 17—The Oliver Iron Mining Company has been commended by Andrew Horngren, deputy State labor inspector of Minnesota, for the adequate safety devices provided at its mines on the Mesabi range. The installations on that range are similar to those in the Michigan mines, and have been the results of detailed reports of committees appointed by the Oliver organization for inspecting the mines on surface and underground. The Cleveland-Cliffs company is following the same policy and intends to maintain a permanent department for safeguarding employees; William Connibear, formerly in charge of the company's exploration on the Menominee range, has been appointed head of the new department.

Recently, during a few days of warm weather, when the ore would not freeze in the docks, several of the iron districts hurried large consignments of ore to the docks. This was particularly true of the Crystal Falls district, where the Bristol mine of the Oglebay-Norton company, the Mansfield mine of the Oliver company, the Great Western of the Corrigan-McKinney company, and the Hollister mine of the M. A. Hanna company, were shippers.

Wallace, Ida.

Nov. 14—The county commissioners recently proposed to clear a 50-ft. right-of-way on the road from Murray to Thomson's Falls. This road is used by the mining companies in that district to haul supplies and the ore from the Jack Waite mine is hauled to Murray over this road. If the right-of-way were cleared and the road rebuilt the haulage would be excellent. The expense, however, was more than the county could afford. When a lumber company offered to do the clearing work for the lumber cut, it was thought that the improvement was assured. The road is through a forest reserve and at a time when everything looked favorable an agent of the forestry department notified the county officials that any timber cut could not be used. The timber could be burned on the ground but could not be used for mining purposes or for fuel. It could, however, be wantonly destroyed. This is evidently a new phase of conservation.

The unusually dry autumn followed by snow and cold weather threatened to cause much trouble for some of the mining companies. Several mines which depend upon water for power were forced to close. The Success mill shut down owing to the low water and the freezing of the flume and the Hercules large flume became choked and caused trouble until it was cleaned. Teamsters coming in from the divide, six miles from Wallace, report 8 ft. of snow there. The cold weather has broken up, however, and the warm rain which fell for 24 hr. recently is sending plenty of water into the creeks. All the mines have resumed operations.

Toronto

Nov. 17—There is some renewal of activity in the Larder Lake district, a large number of claims having been restaked. In all 1200 locations have been made there this year, the great majority being restakings. The 20-stamp mill of the Doctor Reddick, which ran for a short time three years ago, will soon be put in operation, development work carried on while the mill was idle having opened a quantity of ore. The Goldfields, Ltd., a consolidation of the Harris-Maxwell, Tourmenie and Proprietary properties, is installing a power plant for the operation of a stamp mill.

It is generally expected that the Amalgamated Asbestos Corporation, Ltd., will default payment on bonds due Dec. 1, and a committee has been named to call for bonds to be deposited at the Commercial Trust Company in Philadelphia. The directors will meet in a few days to request the trustee to call a meeting in Montreal of all the bondholders. It is stated that the company has suffered from declining prices for asbestos, brought about by competition, as well as from permitting grades to deteriorate. Competition was not met promptly as the management believed the decline to be temporary. This proved not to be the case and as deliveries were not called for, operations were reduced until for the nine-months period ended Sept. 30 the mills only operated for six months and at ½ capacity. Better grades of material have been made recently and it is hoped that with wise management the company will soon recover lost ground.

Porcupine

Nov. 16—Despite the predictions of the brokers and a great part of the press, conditions in Porcupine seem to point to a rather dull winter. A large number of men are looking for work, and business generally is slack. At the mines work is progressing rapidly and large numbers of men are employed, but with many of the smaller properties there seems a tendency to hold back, which is probably due to lack of funds. It is altogether likely that these conditions will exist until some of the mills start producing bullion, which will hardly be before March, 1912. After that there should be a revival of interest and money should be more plentiful. Operators in Porcupine have had a great deal to contend with and it takes a long time to reach the producing stage; when this has been reached, however, Porcupine will be fully able to demonstrate its position as a gold camp.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Alaska

A shipment of tin concentrates recently left Alaska for Seattle on the S.S. "Corwin," from Nome. This shipment consists of 92.99 tons of ore, estimated as worth $47,000, and comes from the claims owned and operated by the York Dredging Company, W. W. Johnson, president.

Montana—Some good ore has been encountered on this property in the Hot Springs district, owned by Smith & Spencer.

Silver King—The owners of this property, E. R. Walker and Tom Utigard, of Fairbanks, are planning for considerable development work in the spring.

Granville Mining Company—A. N. C. Treadgold has acquired various gold-dredging properties, totaling about 27 miles along Dominion and Hunker creeks, for this company in which British capital, represented by the Consolidated Goldfields of South Africa, is interested. The Granville company was formed under English laws, with a capial of $1,200,000. Considerable testing of the claims is said to have been done and it is reported that dredges will be installed.

Ibex and Mayfield—The company owning these claims near Valdez is considering the erection of a stamp mill. M. M. Reese is president.

Carnegie-Hatcher—This group of claims in the Willow Creek district has been sold to a company represented by S. S. Loeb and I. Rosenthal, of Seattle. Considerable machinery will be installed. H. D. Gowen will be in charge.

Chicagoff—The SS. "Northland" arrived in Seattle, on Nov. 15, with a $300,000 cargo of gold concentrates from this mine near Sitka. In addition to this shipment, the mine is making regular shipments of bullion.

Kennicott—This company is making preparations to develop some low-grade copper claims adjoining the Bonanza. The Erie, Independence and Jumbo claims are included in the plan. Stephen Birch, Seattle, is manager.

Arizona

Cochise County

Commonwealth—Plans and specifications are being prepared for a 300-ton mill to be installed at the property at Pearce.

Gila County

Inspiration—Managing director W. H. Aldridge has recently left New York for the West. During his stay there, it was decided to proceed as soon as possible with the construction of the plant. The extension of the Arizona Eastern railroad's branch from Miami to the company's tunnel will be begun immediately. Grading for the 5000-ton concentrator will begin some time before January.

Uneeda—The company has resumed development work on its group of 17 claims in the Pinal mountains near Miami.

Live Oak—The latest official statement as to the tonnage developed by the company is 19,000,000 tons of ore averaging 2.11 per cent. copper. Of this amount over 15,000,000 tons will average 2.25 per cent. These are the figures given out by Charles Hayden, of the firm of Hayden, Stone & Co. which financed the last two stock issues of the company. After his visit to the mine recently, Mr. Hayden announced himself as satisfied with the developments to date and said that the company could have all the money necessary for future development and equipment. At shaft No. 2, near the western end of the property, a station is being cut in the ore at a depth of 800 ft. and this end of the orebody will be further developed. Development is also in progress from No. 1 shaft and four churn-drills are in operation.

Arizona Commercial—The mine still remains idle. Superintendent H. H. Dyer, with a few men, is at the mine keeping it free of water and maintaining the railroad in operation. The two Prescott station pumps are now handling 700,000 gal. per day, the same as at the Superior & Boston.

Maricopa County

Monarch—The company expects to have its new 100-ton mill installed at its mine in the Wickenberg district by Dec. 31.

Mohave County

Gold Crown—The final payment has been made on the property by the Frisco Mines and Power Company, that has been operating it for the last two years. A considerable amount of $12 ore is said to have been developed and it is possible that a 500-ton mill may be built.

Needles—This company, operating the Tennessee mine, is opening a drift from the 700-ft. level and the latter is reported to be near the place where the old ore-shoot is expected to come in.

Oro Plata—The mill was recently placed in commission at the property in the Kingman district and is said to be doing good work.

Yavapai County

Yarnell—Machinery is reported as being ordered for a 250-ton cyanide plant to be erected at this property in the Weaver district. The mine is one of the old gold producers of the State and is said to have been purchased recently by a Philadelphia syndicate. An appropriation has been made by the new owners to purchase new machinery, to renovate the old buildings and to carry on underground operations. The mine is developed principally by tunnels, but there is one shaft 200 ft. deep. A five-mile pipe line furnishes the camp with water. A force is now at work under W. B. Twitchell, Phœnix, general manager, and Rex W. Dunlap, superintendent.

Arkansas & Arizona—At this mine near Jerome, three full shifts are sinking the shaft. Sulphides are reported in evidence and the rock is becoming more mineralized with depth.

Jerome-Verde—It is believed that work will soon be resumed at this propery. I. M. Sutton, secretary, has been in New York and Florida for several months in the interests of the company and it is said that his mission was successful.

Calfornia

Amador County

Rose—A new electric pump is being installed, power to be furnished by the Pacific Gas and Electric Company.

Plymouth—This mine, idle since the fire in the '80's, is reported to have been taken over by the Bewick, Moreing Company, of London, which will proceed to operate it.

Alma—It is reported that there is a prospect of reopening this mine which is within the limits of the town of Jackson. The shaft is 1000 ft. deep; the hoist, boilers and other machinery are in fair condition.

Argonaut—The new Westinghouse electric hoist has been tested and found to be satisfactory. The head office has

been moved to San Francisco; the local office will be maintained.

South Eureka-Oneida—A drift will be run on the 2400-ft. level from the Oneida toward the South Eureka, connecting the two mines. The Oneida shaft has been unwatered below the 1700-ft. level.

BUTTE COUNTY

Mammoth Channel—According to W. H. Finchley, superintendent of this mine at Magalia, the southeast crosscut has been extended to 215 ft. and the channel tapped by a 28-ft. borehole, cutting sand, gravel and water, and indicating the right course for the main channel.

South Banner—High-grade ore is reported at this mine near Oroville, one of the earliest producers in the country. Edward Livesley is manager.

Crystal Hill—This mine near Magalia is being pumped out in preparation for renewed operation.

CALAVERAS COUNTY

Calaveras Copper—This company is putting in new machinery and a supply of fuel oil for resumption of work on a large scale.

Lightner—High-grade ore is reported on the 400-ft. level.

ELDORADO COUNTY

Lucky Baldwin—The shaft has been unwatered at this mine, sometimes called the Nashville, and a strong vein of high-grade ore is reported to have been uncovered. M. L. Effinger is owner.

FRESNO COUNTY

Mercy Mining and Development—This company has given a purchase option on the Powderhouse and Aurrecolches quicksilver mines in the Little Panoche district to S. D. Chittenden, of San José, at a reported price of $50,000. The agreement requires the erection of a 20-ton furnace at once. The Pacific Quicksilver Company is the name of the new incorporation organized to take over the mines. The capital stock is $500,000; A. E. Eaton, Lewis A. Sage, S. D. Chittenden, J. A. Shields and H. R. Fry, of San José, are incorporators.

INYO COUNTY

Golden Rod—This mining company owning the old Desert Queen mine has remodeled the cyanide mill, and the crew of 10 men will be increased.

KERN COUNTY

A decision of the local land office recognizes the validity of a mining location based on discovery of 35 per cent. gypsum; former rulings insisted on 80 per cent. Testimony was adduced showing the commercial value of the lower per cent. for land plaster.

NEVADA COUNTY

North Star—The new electric pump for the Providence shaft built at the Taylor foundry, Grass Valley, is completed; the electric cables have arrived, linemen are repairing the line between Colgate and the Champion and the pump foundations are under construction. The installation of this pump will render unnecessary the operation of the various pumps on the Champion group. The road from the Champion to Nevada City is being repaired and the road from the upper Grass Valley road to the Providence has been completed, reducing curves and grades.

PLUMAS COUNTY

Copper Queen—It is reported that the recent strike in this mine at Portola has been found to warrant the installation of machinery. The vein is being developed by tunnel.

SAN BERNARDINO COUNTY

Atolia—The milling plant at this tungsten mine has been overhauled and a crushing plant is being installed.

SHASTA COUNTY

Golinsky—This property, situated four miles west of Kennett, just north of the Mammoth and across the gulch at the head of Big Backbone creek, is reported to have been sold to German men through George Bayha, resident manager of the Evening Star. Development of this group of 14 claims was begun several years ago and the property has been examined for Eastern men within the last 10 years.

SISKIYOU COUNTY

Bullion Mountain—Seventeen tons of high-grade ore are being shipped to the smeltery at Kennett. R. Palmer is manager.

Sterling—Lumber is being milled for the erection of a cyanide plant at this mine. E. M. Foudray is superintendent.

TUOLUMNE COUNTY

Mt. Jefferson—This mine, after more than seven years of idleness, has been reopened by George J. C. Donaldson and the mill again put in commission.

App—Capt. W. A. Nevills, president of the Rawhide Mining Company, states that the main shaft which is 400 ft. from the point of the recent cavein was not damaged; that the result has been a benefit in filling stopes and exposing a large vein of good ore.

YUBA COUNTY

The bid of the Yuba Construction Company for the settling-basin lands on Yuba river at Hammonton, is reported to have been accepted by the Government.

Manzanita—A new hoist is to be installed at this mine in the Rackerby district. The shaft is down 300 ft., uncovering a 6-ft. vein at the bottom. T. Johnson is superintendent.

Tarr—The ditch is being strengthened against slides. The dredge is said to be nearing completion, for the handling of the gravel that is to be cut out with giants.

Colorado

CRIPPLE CREEK DISTRICT

In September, Stratton's Independence production was 2299 tons averaging $18.05 per ton. Low-grade and dump ore milled amounted to 10,500 tons; net working profit to the company, $11,555.

American Eagles—The October output was 12 cars, averaging $60 per ton. This property is owned by the Stratton estate and is leased by the Colorado Mines and Investment Company, Paul Hines, superintendent.

Western Investment Company—During October this leasing company produced 50 cars of milling ore.

Portland—One of the permanent good effects of the recent flow of water encountered in the deep drainage tunnel is the fact that the Portland mine, on Nov. 14, was dry below the lowest or 1500-ft. level, and it is considerably over a mile in a straight line from the tunnel heading to the above mine, which in the past has produced gold ore worth $35,000,000, and paid nearly $9,000,000 in dividends. It is now believed that the entire camp will be drained, making an average of 730 ft. in depth over the whole district, which can now be mined without the enormous cost of pumping hitherto involved.

Trilby—The October output of this mine by four sets of leasers was 34 cars of mill ore.

LAKE COUNTY—LEADVILLE

Penn—From shaft No. 3 in this Breece Hill mine the leasers, Lanphier, Hanifen & Reynolds, are shipping regularly about 200 tons of iron ore per day.

Yak Tunnel—During the month of October the output of ore by lessees and the company was 12,000 tons of ore of different classes.

OURAY COUNTY

Camp Bird—Estimated net profits for September were about $206,000, as compared with $154,565 for August.

SUMMIT COUNTY

It is estimated that the output of gold by the three companies operating their dredges in the Breckenridge placer district will reach about $700,000. The Colorado Gold Dredging Company, the Reliance Gold Dredging Company and the French Gulch Dredging Company have had their boats at work during the entire season.

Wellington—This mine is the leading lode producer of the district and the concentration mill is handling 95 tons of crude ore per day. The working shaft is being sunk deeper, with three shifts. It is stated that the zinc middlings, waiting the installation of a magnetic separator, cover an acre to a depth of about 20 feet.

Idaho

Coeur D'Alene District

Best Chance—The company has let the contract for the last 300 ft. of the lower tunnel. According to the survey this increased length should cut the vein. The tunnel is already in 1240 ft. Work on the additional 300 ft. will start at once.

Gold Hunter—The work of retracking the long tunnel at this property is rapidly nearing completion. Electric haulage is to be installed and the motors will be ready to run as soon as the new track is finished. A sorting plant is to be built in connection with the remodeled mill. Crude ore will be shipped from the mine when the plant is in running order.

Diamond Jim—Work on a larger scale has been resumed on this silver-lead property, on the shore of Lake Pend d'Oreille. Shipping is expected to start next spring.

Shooneah—The company owns a group of 10 claims on the Cœur d'Alene divide. Ten tunnels have been driven on the property and one is about 2000 ft. long. This encountered a silver-lead vein, supposedly the Blue Bird.

Lemhi County

Kirtley Creek—The company is completing its sluice boxes. The 9-cu.ft. dredge is being operated successfully, five miles from Salmon City. The plant is run with electric power. It is estimated that six years will be required to clean up the present ground.

Nez Perces County

Hydraulic Placer—The company is ready to commence washing on its property in the Salmon river, 15 miles from its junction with the Snake river. The flume is ready and with two giants it is hoped to wash 1000 cu.yd. per day.

Michigan

Copper.

Mass—Work under the management of Superintendent Walker is showing most encouraging results. C shaft is sinking on the Butler lode at a depth of about 1250 ft., and drifting is being done at all levels from the fourth to the ninth, inclusive. B shaft on the Evergreen lode is bottomed at the 17th level.

New Baltic—Shaft sinking has resumed below the 360-ft. level. At 500 ft. another level will be started and the formation explored at that point. On the 360-ft. level some encouraging ground was opened.

North Lake—The company has started cleaning ground in proximity to the No. 3 drill hole, where a shaft is to be sunk early in 1912. The 15th drill hole is being put down and will complete the cross-section of the tract.

Indiana—The shaft at this property is down about 425 ft. on its way to cut the lode at depth.

Calumet & Hecla—The company has established a mine rescue station and has a complete equipment in charge of G. W. Hawes, formerly of the Illinois Government station.

Algomah—Work has started on the cutting of a plat at the 200-ft. level, where a crosscut will be driven to the Lake lode.

Franklin—The new hoisting equipment is being rapidly assembled and will be ready for duty about Jan. 1, 1912. The shaft is being straightened and widened to 5 ft. to accommodate a large skip. Hoisting will be done with a single skip, and the energy of the descending skip and rope will be utilized in compressing air, which in time will help out in hoisting the loaded skip. Repairs and alterations are being made at the stamp mill. Pending these repairs, mining has been suspended, but there are large reserves to draw from as soon as production is resumed and the property will be in shape to handle a materially increased tonnage.

Iron

Chicagon—At this mine of the Munro Iron Mining Company, seven miles east of Iron River, a new coal trestle is being completed to the boiler house. This property has improved greatly in appearance during the last year and has now a fair equipment. The company has been exploring this property for three years and has succeeded in finding several orebodies. Previous to the taking over of the property by the Munro company, which is a Rogers-Brown subsidiary, the Oliver Iron Mining Company is said to have spent $60,000 in an unsuccessful attempt to find ore.

Rolling Mill—This mine, situated in the soft-ore basin, south of Negaunee, is raising from underground workings for a new shaft, which will reach surface several hundred feet south of the present shaft. It is planned to finish the rock work by spring, when a steel headframe will be erected; the new shaft will be used for hoisting and will safeguard the mine for the escape of miners in case of accident. The mine was formerly a small open-pit mine, but several years ago a shaft was sunk east of the pit, since which time the property has been shipping about 130,000 tons of ore per year.

Jones & Laughlin—This company's property, one mile north of Iron River, has been diamond-drilled and a large orebody indicated. The tract consists of one 40-acre tract, situated near the Davidson and James mines, and the fee is held by the Gleason interests of Escanaba. William Walters, formerly of Ishpeming, is superintendent of the Jones & Laughlin company, in the Iron River district.

Wickwire—At this mine, on the Coe property, near the village of Iron River, a shaft has been sunk and drifting has been going on for several weeks; the crosscut to the orebody, which the Cleveland-Cliffs company had previously drilled, has gone through a lens of ore hitherto unknown.

Cortland—The exploratory shaft on this property, west of the Hiawatha mine, which was started by W. H. Selden, has been deepened and a body of ore opened; it is predicted that this mine will eventually be one of the good-sized producers of the district.

Minnesota

Cuyuna Range

It is reported that the Ogelbay-Norton company, of Cleveland, Ohio, has secured a lease of the C. H. Hill properties in S. 10-T. 46-R. 29, and that Cole & McDonald have placed four diamond drills on the land to explore it and to check up the drilling previously done by B. Magoffin, Jr., of Deerwood. The Ogelbay-Norton company is a firm of ore merchants, and its entrance here is an event in the history of the Cuyuna range.

Mesabi Range

Holland—An explosion caused a fire recently that destroyed the dry, boiler and engine houses. The shock was felt for some distance, and one man was injured.

Oliver—It is reported that the company will maintain full forces on stripping work during the winter.

Crosby—It is probable that the Cleveland-Cliffs company will operate this mine next season.

Biwabik—The mine has ceased operations until next spring. Only a few men will be employed during the winter.

Missouri

Oakwood—H. C. Cornell, of Carthage, has purchased this mill which he will erect at a new mine at Knights Station.

Nevada—This smeltery has been overhauled and is about ready to begin operations.

Mattes—This company is sinking a shaft on a lease at Thoms Station.

Bertha A.—The company has taken over the Winslow mine and two mills at Webb City and will repair the mills and operate the mine. Thomas Douglas, J. J. Anderson and William Aul, of Joplin, compose the company.

Chapman & Lennan—This company, of Webb City, has purchased the Nannie M. lease on the Walker land at Duenweg on which two rich strikes have recently been made.

Montana

Butte District

Anaconda—At the West Gray Rock mine, which was closed down for some time for repairs, operations were started again Nov. 1, and at present there are about 175 men employed there and 400 tons of ore per day are being hoisted.

The hoist at the Little Mina mine has been dismantled and transferred to the West Gray Rock mine, where it has been installed with compressed air as the motive power instead of steam. The shaft of the East Gray Rock mine has been closed down and the mine is now being worked through the West Gray Rock shaft, which is now down to the 1300-ft. level; plans are being made to continue sinking to the 1600-ft. level in the near future.

Butte & Ballaklava—The shaft is being sunk at present from the 1400-ft. level, and will be continued to the 1600-ft., where a station will be cut and crosscutting to the vein started. A vein which is not included in the suit of the Amalgamated company has recently been cut, and ore averaging from 4.5 to 7.3 per cent. copper uncovered.

East Butte—Plans are being made by the directors for financing the purchase of the Pittsmont property, upon which about $2,500,000 is owed, and it is likely that a part of it will be paid from net earnings, as it is the purpose of the management to keep the capitalization as low as possible. The company is now earning at the rate of $420,000 per year, or $1.40 per share on the 300,000 outstanding shares of stock, basing the output at 12,000,000 lb. of copper, produced at a cost of 8.5c. per pound.

Boston & Corbin—At this property 1298 ft. of drifting were done in the last year on the seventh, ninth and twelfth levels. Drifting on the seventh level opened ore of an average width of 3 ft. A drift extended 639 ft. on the 900-ft. level averaged 1 ft. of ore for the first 300 ft., and ore 3 ft. wide for the remaining distance. On the 1200-ft. level 400 ft. of barren vein matter was drifted on, after which ore varying in width from 6 in. to 6 ft. was drifted on for 200 ft. and the face is still in a concentrating grade of ore 2 ft. wide. Reserves were increased by 50,000 tons during the year. Development and construction amounted to $88,000.

Broadwater County

Combination Keating—Officers of the Cactus Copper Company, a Minnesota corporation, have been authorized to acquire the Combination Keating property in the Radersburg district on a stock-payment basis. The Cactus company is reported to have sufficient money to develop the mine properly, and will have 200,000 shares of stock left in its treasury after paying for it.

Granite County

Royal Basin Mining and Milling Company—The ore at this mine is a carbonate of copper in a sandstone gangue. A leaching plant is being installed for the treatment of this ore and the cycle of operation is as follows: Crushing to 20 mesh, leaching with 5 per cent. sulphuric-acid solution, crystallizing out in evaporating pans and precipitation by electrolysis, after bringing the copper sulphate into solution again. John D. Fields, Princeton, is manager.

Lincoln County

W. H. Graham, of San Francisco, recently purchased 880 acres of placer ground on Libby creek from William Criderman, at a cost of $28,000. He intends to work the property next summer by the use of a hydraulic plant, the material to be carried to the ground over the snow this winter to be ready for operations in the spring. A preliminary survey is being made for a pipe line to the property.

Nevada

Comstock Lode

Con Virginia—An improvement was noted recently in the prospecting work on the 2550 level, ore assaying $10.50 per ton being mined.

Sierra Nevada—The croppings are being sampled with the possibility in view of constructing a tram in the spring, for the shipment of the low-grade ore to the Mexican mill.

Union Shaft—Extensive repairs have been started on this shaft, beginning at the 2000 station, and will be continued to the surface. While this work is in progress it will interfere somewhat with the hoisting facilities and as a consequence mining work in the Union and Mexican will be on short time. It is proposed to place the shaft in first-class condition to have it in readiness for the large tonnage of ore to be raised steadily, when the new Mexican mill begins operations next month.

Mexican—The steel tanks for the new mill filter are being installed. Practically all of the machinery for the mill has been received and all that remains to be shipped are a few small motors. The company has already expended $54,000 for the plant and when it begins operation it will be free from debt. The total cost is estimated at about $60,000. The storage bins on the surface are filled to capacity with milling ore, conservatively estimated to be worth $300,000. Ore opened in the mine above the 2500 level is estimated at $1,500,000.

Ophir—After paying the dividend of 10c. per share on Nov. 6, there remained a balance of $37,000 in the treasury with no outstanding indebtedness. A railroad car of concentrates was shipped to the smeltery last week, and a run on 2000 tons of ore will be completed at the Kinkead mill next month.

Julia Consolidated—Preliminary work has been completed for the raise on the 2000-ft. level, diamond-drill holes sent out above the first floor showing no presence of water to interfere with the work. The raise will connect with an old winze from the 1600-ft. level.

Churchill County

Nevada Hills—The report for October shows that the 40-stamp mill treated an average of 100 tons of ore per day, averaging $28 per ton, the net profits for the month's operations being slightly over $43,000. It is believed that the capacity of the plant can be increased to 110 tons per day in a short time.

Lincoln County

Mendha-Nevada—Arrangements for bonding the property are said to be progressing favorably in Salt Lake and a favorable ore contract having been secured, it is expected that operations will be resumed at an early date.

Pioche Coalition—Development work is progressing favorably on the Golden Prince property where an important strike was recently made, and assessment work is being performed on the Golden Crown property. Its claims are now being surveyed for patent.

Day-Bristol Mining and Smelting Company—George E. Bent is general manager. The mine is being operated by J. R. Bent, a brother of the general manager. The average production from the Day mine for the last seven months has been 60 cars per month. No work is being done on any of the Bristol claims. There are no signs, as yet, of commencing work on the much talked of Day-Bristol tunnel.

Prince Consolidated—The property is idle, but announcement was made recently that ore contracts had been signed and that the company was ready to deposit the money necessary to build an extension from the present Pioche terminus of the Salt Lake route around the western end of the Ely range to the Prince mine, a distance of about six miles. When this extension is to be built has not as yet been decided, but work has been commenced on a spur from Panaca to Bullionville to facilitate the handling of tailings to be shipped from that point by the Prince company.

Nye County

Montana-Tonopah—The company, on Nov. 14, made the first payment on the Commonwealth mine, at Pearce, Cochise county, Ariz., which it has purchased on a working option, and the development of the property on the 450-ft. level is being conducted by Llewellyn Humphreys, of Salt Lake.

Tonopah—The report of the company for October shows that 15,261 tons of ore, averaging $18.86 per ton, were milled with an extraction of 91.9 per cent. The company shipped out gold and silver bullion worth $220,450, and 87 tons of concentrates worth $43,855, the net profits amounting to $145,562.

Tonopah-Belmont—The report of the company for October shows that 7774 tons of ore were milled and 2550 tons

shipped to the smelteries, the gross receipts amounting to $302,951, and the net profits, $163,798.

WHITE PINE COUNTY

Nevada Consolidated—Work is to be resumed in the Veteran mine, which has been idle for a long time because of labor difficulties. The men struck for the same wage, $3.50, for miners and muckers, the company being willing to pay only $3 for muckers. The men have now come to the company's terms. Operation of this mine will insure maintenance of the ore supply of the mill during the winter, when trouble is likely to be experienced by freezing of the ore from the Eureka mine. It is improbable that any ore will be extracted from the Ruth mine until after the Veteran has been exhausted.

New Mexico

Black Range Custom Reduction Works—The company, at Fairview, will enlarge its present plant to 100 tons capacity and will require additional machinery, including an aërial tramway.

Ernestine—The new orebody opened below the main tunnel is reported to be over 20 ft. wide. The last 19-day cleanup in October is said to have yielded 10,465 oz. of bullion and five tons of high-grade concentrates. E. Craig, president of the company, has been in camp inspecting the property and the new machinery installations.

Deadwood—The third level west has opened good ore. The mill continues its regular production of bullion and concentrates.

Mogollon Gold and Copper—Both the old Cooney mine and the Little Charlie are producing a good-grade ore. Smeltery shipments are being made from the former while 10 tons per day are being treated in the Deadwood mill from the latter.

Socorro—The first delivery of crude oil for the De La Vergne engines was made recently. Erection of the new power house is progressing rapidly.

Oregon

Mountain Lion—This company is considering the installation of additional machinery at the mine near Grant's Pass, Josephine county. C. C. Daniels is at the head of the company.

Highland—New machinery is being installed at this mine near Sumpter, Baker county, and a car of ore has been shipped to the smeltery at Salt Lake for testing purposes.

North Pole—Operations at this property, Baker county, are to be resumed at once, under the direction of Albert Geiser, Sumpter, who recently took the mine over.

Utah

BEAVER COUNTY

Sheep Rock—During the last few months $7500 worth of gold and silver has been produced. A good quantity of ore not included in the above amount is ready for shipment. The lease to the Robinson brothers, operators, expires in a few weeks.

Horn Silver—Slag from the extensive dumps is being tested; it is said that, with a profit of 50c. per ton, $50,000 could be cleared.

JUAB COUNTY

Tintic shipments for the week ended Nov. 10 were 158 cars, showing a gain of 13 cars over the week preceding. This is approximately 7900 tons, which, estimated at $20, would be worth $158,000. The Iron Blossom showed a gain of eight cars; Scranton, one, and the Gold Chain, two. The weekly tonnage of Tintic compares favorably with that of any camp in the country, with the exception of the low-grade copper camps.

Victoria—A body of shipping ore is being developed in the winze from the 1050-ft. level. The drift on the 1200 is being driven through quartz, carrying bunches of good ore. Two cars per week are being shipped.

Sioux Consolidated—The raise from the 600-ft. level is up 115 ft. When connections have been made with the 450-ft. level, the orebody now opened in the winze will be developed.

South Iron Blossom—Assessment work has been completed and several claims will soon be patented. Work in the main tunnel where there is an encouraging showing will be resumed in the spring.

Opohongo—The new ore house is nearly completed. Ore has been opened on the 700-ft. level, and connections will be made with the 600, so that the ore can be taken out to the shaft on the 700. Two cars per week are being shipped.

Colorado—The annual stockholders' meeting will be held Nov. 18. About 10 cars per week of ore of good grade are being shipped from the 250-ft. level near the Sioux line.

Crown Point—The shaft is 450 ft. deep and will be continued to the 500, where it is hoped the body of leached-out quartz, opened on the 400 level, will continue. Crosscutting will be done on the 500, and if this fails work may be continued to greater depth.

Old Colony—The hoisting machinery is being dismantled; the shaft is down over 300 ft., and the present equipment is considered too light for further underground development. The management states that with the resumption of operations new equipment will be installed. The property adjoins the Lower Mammoth and the Black Jack.

SALT LAKE COUNTY

Kennebeck—There is 2½ ft. of ore in the upper tunnel of this Big Cottonwood property, and leasers have made a shipment, taken out in development, said to run $40 per ton in silver and lead. Work will be carried on during the winter.

Cardiff—The new lower tunnel is in 100 ft. Steady shipments of high-grade copper ore are being made. Snowsheds, cabins and blacksmith's shop are ready for the winter.

TOOELE COUNTY

Lion Hill Consolidated—A report to stockholders has been made by the treasurer. High-grade ore has been opened in the Chloride Point incline, from which seven cars have been shipped from development. Considerable low-grade ore carrying from 5 to 30 oz. in silver and $1 to $3 in gold is reported to have been opened. Development is being done in the east-side tunnel to crosscut the vein. Machine drills are in use. Plans and specifications are being prepared for rebuilding the mill to treat the lower-grade ore. The mill buildings, some of which can be used, are still on the property, and about $4000 worth of new equipment is required.

Boston Sunshine—The mine was closed down several months ago and the mill and supplies were sold to the Mineral Hill company, of Nevada, from which sale the last dividend, totaling $5632, was derived. This will probably be the last dividend of the company. The property is in the Camp Floyd district, about four miles south of Mercur.

Washington

Onxy—This marble company is contemplating more extensive operations at the mine, near Leavenworth, and is also considering the erection of a cement plant. John L. Atkinson is president.

McKinley—A contract has been let for lengthening the tunnel on this property, in Ferry county. W. A. Champion, Orient, is in charge.

Ben Hur—Operations are continuing at the mine, in Ferry county, and the main shaft has been completed to the 500-ft. level. Jack Benson, Republic, is superintendent.

Canada

ONTARIO

Manion-Fawcett—This property in the Sturgeon Lake district has been purchased by a syndicate headed by M. L. Foley and W. B. Leyson for $50,000. A force of 90 men is engaged in development work.

ONTARIO—COBALT

Provincial—The main vein has been sunk on for 16 ft. below the 200-ft. level, in good ore all the way.

Little Nipissing—A decree has come into force increasing the capital stock of the company from $1,500,000 to $3,000,000 to cover the illegal issue of certificates representing a par value of $1,250,000. The directors are empowered to issue four-fifths of the balance of the shares not required to replace outstanding certificates at such discount as they think proper, the remaining one-fifth being retained for sale at a later date.

ONTARIO—PORCUPINE

Scottish Ontario—New machinery has been ordered including two boilers, hoists, pumps, and a number of stamps for testing purposes.

Crown Chartered—The crosscut at the 100-ft. level is now in over 100 ft. and has passed through 50 ft. of vein matter, of which 20 ft. is schist probably averaging about $6 per ton, 10 ft. of schist showing better, and 20 ft. schist and quartz, both carrying free gold. The schist has also considerable iron content, which is regarded as a favorable indication.

American Goldfields—Diamond drilling will be undertaken at once to test the orebodies at depth. Free gold has been found in No. 3 vein, and other veins are heavily charged with sulphides.

Dome—According to an official statement by Ambrose T. Monell, managing director, there are two drifts at the 50-ft. level, one of which runs uniformly for 136 ft., carrying $28 per ton; the other, running parallel, carries $30, except for the last 20 or 30 ft., where it runs over $40. Below that level diamond drilling has shown good ore, but the grade cannot at present be definitely announced. Under what is known as the "golden stairway," a diamond drill put down 200 ft. showed high-grade ore. The diamond-drill course, taken at points 1000 ft. apart and put down from 200 to 750 ft., gives varying results up to as high as $1000, but it is impossible to strike an average.

Preston-East Dome—It is stated that this company will absorb the Brydge and Martin claims, which adjoin it. The dip of the Brydge vein, which was found a short time ago, is expected to carry it into the Preston ground at about 200 feet.

McIntyre—Work is being prosecuted through five shafts and good results are reported.

Achilles—A small plant will be installed soon.

Hughes—A number of new buildings are being erected and a complete plant is to be installed.

Digby—A large contract has been awarded for diamond drilling this property.

Porcupine Reserve—This company is operating four shafts and is opening up some good ore.

Mexico

CHIHUAHUA

Bueno Tierra—This mine, in the Santa Eulalia district, which was purchased late last year by the Exploration Company of London and Mexico for $600,000, has been developed with satisfactory results. Shipments are being sent to the Chihuahua smeltery of the American Smelting and Refining Company.

La Cruz—At this mine, in the Ocampo district, owned by Krakauer, Zork and Boye, several blocks of good ore were recently developed. The small 10-ton concentrating and amalgamating mill now in use on the property will be enlarged in the near future. A. D. Robinson is manager.

Mexican Mines Corporation—The property of this company, in the Almoloya district, is being developed. Over 500 ft. of drifting has been done, and it is expected that the vein will be cut when the 750-ft. mark is reached. About 25 men are employed by E. J. Ernest, manager.

DURANGO

Restauradora—This mine, in the Guanacevi district, belonging to Ayton & Co., has been sold to an English syndicate for more than $500,000. The reduction plant, which is quite large, is also included in the sale. This mine is a silver property, which was worked a year ago, but operations were suspended pending the arrangement of the transfer to the new company.

San Luis—At this property, in the San Dimas district, new installations and improvements, including the enlargement of the mill and the construction of an aërial tram from the principal shaft to the mill have been completed.

HIDALGO

The Pachuca Railway Company will soon make connections with the Real del Monte district; only a few kilometers of rail laying is needed to connect Pachuca and Real del Monte.

Santa Inez Carretera—On the property of this company a crosscut is being driven to intersect the old workings at the Virgen shaft to the north, a distance of 250 m., where a large body of ore is known to exist, the water from which is drained through the adjoining La Blanca, Barron and Santa Gertrudis mines.

Sonora & Ures—This company is driving a crosscut to the La Blanca lode. At present, 180 m. have been driven, and sinking is being continued at the main shaft.

La Blanca y Anexas—This property has been showing great improvement during the last few weeks, ore of higher grade having been delivered to the mill. Since last December 1500 bars of silver have been cast, of the value of 1000 pesos each.

Cortes Associated Mines Company—At this property at Jacala, a tract of mineral land adjoining the already large properties owned by this company has been acquired. This new property of about 150 acres area is reported to contain veins of gold, silver, lead, copper, antimony and iron. The whole property is in the Zimapan district, and was worked many years ago, ruins of old mine and smelter buildings being frequently met with. Herbert Dunstan will be manager.

Copolo—The plant for the treatment of the sand washed down from the mine and mills of Pachuca, and deposited about six kilometers from the city, has been enlarged. This is the second plant to be erected for this object, the first one being the Blaisdel Coscoticlan Syndicate mill, which had a daily capacity of about 750 tons of sand.

MEXICO

Esperanza—During October the mill crushed 24,799 tons of ore. Gross receipts were $135,885; net, $16,750. Expenditures for construction amounted to $2242, and 1374 ft. of development work were done.

South America

CHILE

Braden—A cable despatch states that diamond-drill hole No. 3 is at present in good ore, the first 110 ft. having averaged 4.82 per cent. copper. This is considered an important development. Two crosscuts from the No. 4 Fortuna tunnel, from which the drill is working vertically downward, are reported to have encountered ore of good commercial grade. A third crosscut is to be started soon. Nos. 2, 3 and 4 tunnels are being driven ahead.

Asia

CHOSEN

Oriental Consolidated—During September the mill crushed 29,457 tons of ore, yielding $144,640 gross and net $70,391. Operating expenses were $68,599 and $5649 were expended on improvements.

Africa

TRANSVAAL.

Gold production in October was: Witwatersrand, 677,923 oz.; outside districts, 30,721 oz.; total, 708,644 oz., being 8019 oz. more than in September. For the 10 months ended Oct. 31 the total was 6,248,831 oz. in 1910, and 6,808,086 oz.—or $140,723,188—in 1911, an increase of 559,255 oz. this year. On Oct. 1 there were 68 mills at work, with a total of 10,312 stamps. At the close of the month there were 179,194 negroes employed in the gold mines, a decrease of 425 from Sept. 30. In addition to the number in the gold mines on Oct. 31 there were 11,319 negroes at work in the diamond mines and 8078 in the coal mines, making 198,591 in all.

The Markets

Coal Trade Review

New York, Nov. 22—Continued cool weather has supported the coal trade in the West, and the mines, as a rule, have increased their activity under pressure of orders received from the large cities and distributing points. Steam trade as well as domestic trade seems to be on the increase. The Lake trade is nearly over for the season, so far as shipments from the mines are concerned.

In the East the seaboard bituminous trade is fairly active. The steam-coal demand is improving, and coastwise trade is being rushed. The demand for vessels is better than the supply and rates are moving upward. The recent storms put quite a number of schooners and barges out of commission.

Anthracite trade is active, also under the stimulus of the cool weather. Large as October shipments were, they seem to have been absorbed without trouble. Steam sizes have been in good demand.

Complaints of car shortage begin to crop up, rather early in the season. Most of them just now come from Illinois and West Virginia.

British Coal Trade—Exports of fuel from Great Britain, 10 months ended Oct. 31, long tons: Coal, 53,257,450; coke, 837,891; briquets, 1,347,495; coal sent abroad for the use of steamships in foreign trade, 16,017,616; total, 71,460,452 tons, an increase of 1,261,235 tons, or 1.8 per cent., over 1910. Imports of coal were only 18,572 tons.

IRON·TRADE·REVIEW

New York, Nov. 22—The iron and steel markets have shown gains in the volume of business in many lines, and buyers seem more disposed to contract ahead.

The general flow of orders for finished steel has shown no change in the past two or three weeks, outside of the improvement made by car and rail buying. This railroad buying may prove to be sufficient to turn the tide and convert an uncertain and declining market into a strong and advancing one, for steel-mill operations, with practically no support from the railroads, have reached a rate of 75 per cent. of the full productive capacity, even though not more than about 90 per cent. of the capacity can be regarded as actually in the reckoning as long as prices stay at the present low level. Using round figures, which are closely indicative though not absolutely exact, the industry ran at the rate of 25,000,000 tons of pig iron a year in 1905-6-7, employing its full capacity, with the railroads taking about 40 per cent. of the finished product, say the equivalent of 10,000,000 tons. In

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

1909-10-11 the rate of production is also about 25,000,000 tons, production last month being almost precisely at that rate, while the capacity is between 33,000,000 and 34,000,000 tons, which shows an operation of 75 per cent. The railroads, however, have not been taking as much as 20 per cent. of the product, or less than the equivalent of 5,000,000 tons, but to operate the industry at 90 per cent. of capacity would not require the addition of more than 5,000,000 tons to the rate, and this the railroads could furnish if they took material at the old tonnage rate, even though this would not constitute as large a percentage of the total output as it did in the earlier years compared, as 10,000,000 tons, 40 per cent. of 25,000,000 tons, would be only 33 per cent. of 30,000,000 tons.

In the past week there has been no distinct decline in prices at any point in the finished-steel trade, this being practically the first week in several months in which there has not been a decline at one point or another. Bars are quotable at 1.05@1.10c., and plates and shapes at 1.10@1.15c., Pittsburg. Any attractive order for early delivery goes at the lower figure named, while small orders go at the higher, and especially good orders, like car plates, go at a special concession. This condition, however, has prevailed for some time.

With the large bookings of car plates and similar material, rails and a few special structural contracts, the unfilled orders of the United States Steel Corporation are likely to show a larger increase this month than they did in October. The gain may reach 200,000 tons. Bookings of other steel interests are not likely to show as large a proportionate gain as they do less in railroad material, and some producers may show a slight loss. The general position of the industry, however, is improved from one week or two weeks ago, with actual production at substantially the same level as during October.

A meeting is being held in New York today of the committee appointed to secure lower rates on coal, coke and iron ore to mills in the Pittsburg district, and a committee from the railroad lines interested.

Baltimore

Nov. 20—Exports for the week included 66,065 lb. zinc dross and 2,559,550 lb. steel billets to Liverpool. Imports included 12,465 tons iron ore from Cuba.

Birmingham

Nov. 20—Considerable iron is still selling in Southern territory but complaint is to be heard as to conditions. There is iron selling for delivery during the entire coming year, but the bookings so far are rather limited except as to the first three months of the year. No. 2 foundry, for immediate and future delivery, is still being quoted at $10 per ton. Reports are current that a little iron is selling below $10, but no verification can be secured along this line. The production in Southern territory is not being disturbed, but intimation is given that curtailment will be necessary if there is not a change in the demand. The accumulated stock amounts to considerable yet.

There is some hope expressed now that the railroads may assist Southern manufacturers with a concession on freight rates, especially to the West. Answers are looked for in the near future from high officials of the railway lines to the requests of the manufacturers.

Chicago

Nov. 20—Except for activity in buying for railroad needs, the iron and steel market continues practically as last week. There is small buying for the needs of the pig-iron trade, though the demand extends gradually into next year's requirements, the average melter being content to buy in small lots, frequently, with an eye always toward the possibility of lowest prices, but no disposition to buy in large quantities until the bottom of the market is reached. The bottom is not yet in sight; hence, everything is quiet.

Pig iron brings practically the same as last week. Southern No. 2 is quoted nominally at $10, Birmingham, which means $14.35, Chicago, and Northern No. 2 at $14, Chicago. From these prices there are possible—even probable—discounts, but no one will undertake to say what they are. In the extreme cases, 50c. off on Southern probably can be had. Perhaps a similar discount would apply to Northern No. 2 moved under circumstances most favorable to the seller. Openness is not a feature of the present market. Northern charcoal sells for $16.50@17, with the supply very limited.

Structural material continues to be

quoted at 1.33@1.38c. for 15-in. material or under; plates are in demand fairly, at 1.33@1.38c. for ¼-in. material; steel bars continue low priced, with the tendency to cut the Pittsburg quotations for local delivery still persistent, but not much business results. The local mills are able to deliver bars at low figures and are forced to overcome low Pittsburg prices. Sheets and plates are quiet. Wire goods are weaker than for several weeks.

Cleveland

Nov. 20—Ore movement has fallen to a very small quantity. Even on that the recent spell of very cold weather interfered with the handling of ore on the docks and the movement of boats.

It is given out that Corrigan, McKinney & Co. are preparing plans for the building of eight 60-ton openhearth furnaces on a site of 41 acres on the Cuyahoga river, which has just been purchased. This land lies on the east side of the river, directly opposite the two blast furnaces of the company. Corrigan, McKinney & Co. have two modern furnaces with a combined capacity of about 150,000 tons per year, but only one of these stacks has been in operation. The second stack, completed about a year ago, has never been blown in. The plant will, of course, produce billets and slabs, and there will be a blooming mill, but whether any material will be finished to a greater extent remains to be decided.

Pig Iron—Not many sales are reported. The best inquiries just now are for basic iron. Foundrymen are taking quite a number of small lots. Quotations, Cleveland delivery, are $15.15 for bessemer, $13.25 for basic, $13@13.25 for No. 2 foundry and $12.50 for forge.

Finished Material—Some good orders are coming in and there is an increased inquiry, covering almost all kinds of material.

Philadelphia

Nov. 22—Iron for pipe foundries is leading all others in activity, not only for early but in two or three instances as late as early-spring delivery. Within 24 hours additional inquiries have been heard of, but this market will not profit by them, as Southern makers are bent on securing this business and appear to be able to make more favorable terms. Basic is still dragging, though prices are recognized to be at their lowest possible limit. A number of large consumers of No. 2 foundry have closed contracts for delivery as late as April 1, and orders for second quarter would have been given had makers accepted them. While demand in the aggregate is somewhat larger, there is not a symptom of better prices. So much iron is available for immediate delivery that buyers are not concerned as to the future. Forge drags and melting at mills is not increasing. Quotations for No. 2X foundry is $15, for both Northern and Southern. Forge has sold a trifle above $14. Basic, $14.50, with $14 offered.

Steel Billets—Expected business in rolling billets is still hanging fire. The few reported sales are for immediate delivery. Basic openhearth sales were made at $21.40 per ton.

Bars—Steel bars maintained the improvement established a week or two ago at 1.20c. Business in iron bars is fragmentary.

Pipes and Tubes—Cast-iron pipe contracts are to be had without much trouble. A large amount of work is under prosecution, much of it in territory where work can be done in winter. Merchant pipe is moving with its accustomed slowness and tubes have regained all they lost in volume, though prices are at the old low discounts.

Plates—A rush of business, both West and East, has strengthened the position of plate makers, by reason of the placing of an immense amount of business by railroads, car builders and engineering concerns, which are under contracts for the construction of large buildings. The steel-plate condition is decidedly stronger.

Structural Material—Big business has been closed for all sorts of work and for delivery all over Eastern territory. The latest shading led to the immediate closing of a great deal of work.

Scrap—The distribution of scrap has increased, by reason of exhaustion of supplies in many mills and foundries, where new work has made replenishment necessary. The higher grades of scrap are holding up well, while the lower grades are plenty and slow of sale.

Pittsburg

Nov. 21—About 18,000 freight cars have been ordered since last report, which noted 20,000 had been placed in about a fortnight. The total of 38,000 cars on this movement compares with 20,000 placed from July 1 until late in October, and not over 50,000 in the first half of this year. Prospects are for some large orders in addition, notably from the Pennsylvania system, and the total on the movement, before the end of the year, may easily run up from the present 38,000 to 75,000 or 100,000. These cars are steel or steel underframed exclusively. In 1907, the best year for car building, the total production in the United States for the domestic roads was about 275,000, of which about 200,000 were all steel or steel underframed. The present capacity of the works in steel and steel underframed may be taken at about 5000 a week. Nearly all the cars recently ordered are for as early delivery as can be accomplished, so that if the movement should run to 75,000 or 100,000 cars practically full work would be provided for the winter.

The effect of railroad-car buying is already felt in the mills, for the Carnegie Steel Company, which gets over half the plates involved in the total of orders lately booked, is this week operating its plate mills at full capacity, whereas in September and October they ran at an average of about 65 per cent. of capacity.

Pig Iron—The Republic Iron and Steel Company has made an arrangement with the Ohio Iron and Steel Company, operating Mary furnace at Lowellville, near Youngstown, by which it will obtain 25,000 tons or more of bessemer iron for delivery in the next two months. The Republic company is operating its bessemer-steel plant practically full and its new openhearth plant nearly full, and needs outside iron. One report is that an outright purchase was made at $14.25, furnace, another report, more generally credited, being that the Republic company had some ores of various descriptions left over at the end of the season, and sold about 68,000 tons, buying in return 26,000 or 27,000 tons of pig iron, the exact prices named not being important on account of ore prices being generally shaded this season. The American Steel Foundries bought 10,000 tons of basic iron from Chicago district furnaces for its two plants in the St. Louis district, at $13.50, Chicago, or $15, delivered. It also bought 12,000 tons for its Alliance, O., plant, at $12.80, delivered, freights being 55c. from the Mahoning valley and 65c. from the Shenango valley. The report is the iron came from the Mahoning valley. From other furnace sales of bessemer the indication is that the market is firm at $14.25, Valley, sales at lower prices being stated to be short sales by brokers. Foundry-iron buying is light. The directors of the Westinghouse Air Brake Company are reported to have instructed their purchasing department to withdraw the recent inquiry for a moderate tonnage of forge and foundry for first quarter. As a rule, foundries are endeavoring to restrict their purchases until the first of the year, but if they buy with any liberality after that date they will put the market up on themselves, as the current production is light. We quote: Bessemer, $14.25; basic, $12.35; No. 2 foundry, $13.25@13.50; forge, $12.75@13; malleable, $12.50@12.75, f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market continues very quiet, and the actual market level is in doubt. A Canton interest is reported to have purchased 300 tons for first-half delivery. We quote the syndicate asking price at $38.50, Baltimore, freight to Pittsburg being $1.95, but it is possible the price could be shaded.

Steel—A cut-price sale of bessemer billets has been made at $18.10, Pitts-

burg. This is regarded as exceptional, and the market is quotable at $18.75@19, Pittsburg, $1 below our last quotation, which was mentioned as being nominal. Openhearth sheet bars have been offered at $19.70, delivered Pittsburg district. We quote: Bessemer billets, $18.75@19, Pittsburg; openhearth, $19@19.50; bessemer sheet bars, $20, delivered Pittsburg district and Youngstown; openhearth sheet bars, $19.50@20, Pittsburg. Rods are nominally $26, Pittsburg.

Sheets—Demand is excellent, probably the greatest on record, but the market continues to be irregular, as there are a number of mills which are keen sellers, although possibly losing some money at present prices. Demand is equal to 75 per cent. or more of existing capacity, although this is 50 per cent. greater than in 1907. We continue to quote: Black sheets, 28 gage, 1.85c.; galvanized, 2.90c.; blue annealed, 10 gage, 1.40c.; painted corrugated, $1.35; galvanized, $2.50 per square. These prices are f.o.b. mill, Valley district, and for actual Pittsburg delivery; $1 a tone more is usually charged on flat sheets, but on particularly attractive orders even the above named prices are occasionally shaded.

St. Louis

Nov. 20—Last week there was about 3500 tons of No. 2 and No. 3 foundry sold. It looks as if there would be about 1500 tons more up to this week. The demand has been rather poor, but as there are some inquiries for additional supply this year, it would indicate that consumption is increasing beyond expectation. The demand for finished products seems to be slightly better. The price of No. 2 foundry iron remains the same, around $10, Birmingham, or $13.75, St. Louis.

The demand for Northern iron has been especially light and the price remains unchanged at $14.25@14.50, St. Louis.

Iron Ore Trade

Shipments of iron ore from the Lake Superior region in October were 4,769,965 tons, being 107,476 tons less than in October, 1911. For the season to Nov. 1, the shipments are reported by the Cleveland *Iron Trade Review* as follows:

Port	1910	1911	Changes
Escanaba	4,507,517	3,764,654	D. 742,863
Marquette	2,998 503	1,956,147	D. 1,042,356
Ashland	3,817,669	2,260,381	D. 1,557,288
Superior	7,802,254	9,315,002	I. 1,512,746
Duluth	13,089,262	6,457,706	D. 6,631,556
Two Harbors	7,763,103	5,853,212	D. 1,909,891
Total	39,978,308	29,607,102	D. 10,371,206

The total decrease this year was 25.9 per cent.

Receipts at Lake Erie ports in October were 4,009,062 tons, or 84 per cent. of the total shipments. The heavier receipts were 1,169,759 tons at Conneaut, 1,069,515 at Ashtabula, 685,549 at Cleveland and 484,187 at Lorain.

METAL MARKETS

New York, Nov. 22—The metal markets generally show some improvement in business, and some rather excited advances in quotations. Tin is again at a high point and copper is active.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Oct. 1911..	$3,983,994	$ 4,102,427	Imp.$ 118,433
" 1910..	750,330	4,250,259	Imp. 3,499,929
Year 1911..	22,247,304	49,279,533	Imp. 27,032,229
" 1910..	56,068,411	49,932,386	Exp. 6,136,025
Silver:			
Oct. 1911..	5,087,087	3,404,458	Exp. 1,682,629
" 1910..	4,269,575	3,395,200	Exp. 874,375
Year 1911..	54,615,048	37,100,888	Exp. 17,514,160
" 1910..	46,034,318	36,652,464	Exp. 9,381,854

Exports from the port of New York, week ended Nov 8: Gold, $36,310; silver, $1,023,495, chiefly to London and Paris. Imports: Gold, $581,593, from Japan, Australia and South America; silver, $87,651, chiefly from Mexico.

Gold—Prices on the open market in London remained at the normal point, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Most of the supplies arriving were taken for France and Egypt. In New York a total of $6,550,000 gold was shipped to Canada and $1,000,000 to Argentina, the latter on Paris account.

From Sept. 20 to Nov. 1 the large total of £3,040,000 gold was shipped from Australia to India direct.

Platinum—The market is rather quiet, the demand from the jewelry trade being about over for the season. Dealers ask $46 per oz. for refined platinum and $48.50 for hard metal, 10 per cent. iridium. The foreign market is steady.

Iridium—Present quotations are $64 per oz. for pure metal.

Silver—Owing to the scarcity of spot silver in London the price for immediate delivery has ruled materially higher than that for forward supplies. The market seems to be in the hands of a speculative syndicate which has control of the immediate situation.

SILVER AND STERLING EXCHANGE

Nov.	16	17	18	20	21	22
New York	56⅜	56⅛	55⅝	56⅜	56⅜	56⅜
London	25 1/16	25 1/16	25⅝	26	26	26
Sterling Ex.	4.8700	4.8690	4.8685	4.8670	4.8680	4.8660

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Shipments of silver from London to the East, Jan. 1 to Nov. 9, reported by Messrs. Pixley & Abell:

	1910	1911	Changes
India	£6,085,000	£7,667,100	I. £1,582,100
China	1,143,500	990,300	D. 153,200
Total	£7.228.500	£8,657,400	I. £1,428,900

India Council bills in London averaged 16.03d. per rupee for the week.

Gold and silver movement in Great Britain 10 months ended Oct. 31:

	Imports	Exports	Excess
Gold	£40,318,636	£32,728,940	Imp.£ 7,589,696
Gold, 1910..	47,002,176	45,222,537	Imp. 1,779,637
Silver	11,754,449	13,853,541	Exp. 2,099,092
Silver, 1910.	11,782,668	11,026,243	Imp. 756,425

Of the silver imported this year £9,839,846 came from the United States.

Foreign trade of the United States, 10 months ended Oct. 31, as reported by the Bureau of Statistics, Department of Commerce and Labor:

Merchandise	1910	1911
Exports	$1,430,635,844	$1,666,025,427
Imports	1,296,408,740	1,264,365,361
Excess, exports	$134,227,104	$ 401,660,066
Add excess of exports, silver		17,514,160
Total		$ 419,174,226
Deduct excess of imports, gold		27,032,229
Net export balance		$ 392,141,997

The gold and silver movement in detail will be found in the table at the head of this column.

Copper, Tin, Lead and Zinc

NEW YORK

Nov.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
16	12¾@12⅞	12.55@12.60	43⅜	4.25@4.35	4.15@4.25	6.35@6.45	6.20@6.30
17	12¾@12⅞	12.55@12.60	43⅛	4.32½@4.35	4.20@4.25	6.35@6.45	6.20@6.30
18	12⅝@12⅞	12.60@12.65	43⅛	4.32½@4.35	4.20@4.25	6.40@6.45	6.25@6.30
20	12⅞@13	12 65@12.75	43⅛	4 32½@4.35	4.20@4.25	6.40@6.50	6 25@6.35
21	12⅞@13	12.75@12.85	43¼	4.32½@4.35	4.20@4.25	6.45@6.50	6.30@6.35
22	12⅞@13	12:75@12.85	43⅜	4.32½@4.35	4.20@4.25	6.45@6.55	6.30@6.40

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The continuous advance in the London standard market brought out a good deal of buying on part of European consumers, and the orders placed on this side for export continued very heavy. The domestic consumer has been late in taking cognizance of the stronger position in which copper finds itself statistically, but during the last week has placed orders upon a more liberal scale than heretofore. In the aggregate the business transacted has been large. It has been chiefly for deliveries after the end of the year, many of the sellers having disposed of all of their expected supply for December, while those who have metal available for that time do not seem to be disposed to let it go ex-

LONDON

Nov.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
16	57 1/16	57 11/16	61¼	197¾	187½	15⅞	26¾
17	57 3/16	57 11/16	61¼	197¾	188¼	15 13/16	26¾
18	.....	.....	.....	.....	.....	.....	.....
20	57 7/16	58 3/16	61½	198½	188¾	15 13/16	26¾
21	57 7/16	58 3/16	61¾	197¾	188¾	15 13/16	26¾
22	58⅛	59⅛	62⅛	198	188½	15⅞	26⅞

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.40c. ± £1 = ± 0.21¾c.

cept at an advance. Under these conditions prices rose practically from day to day and on Nov. 21 the price of 13c., delivered, usual terms, was named and was realized on some business, but transactions were also made at a little under that figure. In view of the rapidity of the advance and the excited state of the market, there has been naturally some variation in prices. Business in Lake copper has been reported as less active than in electrolytic. The close is very firm at 12⅞@13c. for Lake copper, and 12.75@12.85c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 12½@12¾c. as the average for the week.

The strength of the standard market, of which mention is made above, continued throughout the week. On Nov. 22 it developed into rather an excited market, the price advancing at one time almost £1 10 s. above the close of the previous day, but it reacted again on profit-taking. It closes firm at £58 10s. for spot, and £59 5s. for three months.

Copper sheets are 18@19c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire has been advanced ¼c. and is now 13¾c. base, carload lots at mill.

Copper exports from New York for the week were 9000 long tons. Our special correspondent gives the exports from Baltimore at 1704 tons.

Visible stocks of copper in Europe on Nov. 15 are reported as follows: Stocks in England, 46,400; in France, 5620; afloat from Chile, 2130; afloat from Australia, 5300; in Rotterdam, 6300; in Hamburg, 9900; total, 75,650 long tons, a decrease of 3290 tons—7,369,600 lb.—as compared with the Oct. 31 report.

Tin—The activity in the London market abated, and the latter has become very dull. Transactions were small, but prices did not give way much. It is reported that the large backwardation for three-months tin refers to the new contract of the London Metal Exchange only, while future deliveries of Straits and Malacca tin sell on about the parity of spot. The close is cabled at £198 for spot, and £188 10s. for three months.

Some business was done here between dealers for future delivery, which sellers were ready to market at a discount from the import basis of spot. Consumers, however, do not seem to be interested at this time. The market for November and December must be called about 43⅝ cents.

Arrivals of Bolivian tin and tin concentrates in Europe, 10 months ended Oct. 31, reduced to terms of fine tin, were 14,655 long tons in 1910, and 19,394 in 1911; increase, 4739 tons.

Tin output of Federated Malay States, 10 months ended Oct. 31, was 36,561 long tons in 1910, and 35,754 in 1911; decrease, 804 tons.

A shipment of 93 tons tin concentrates has been made from Nome, Alaska, by the York Dredging Company.

Lead—Big orders which were placed with the largest sellers of this metal induced the latter to advance their price $2 a ton late on Nov. 16. At the higher prices thus established, business continues satisfactory, although in a somewhat smaller volume. The close is steady at 4.20@4.25c., St. Louis, and 4.32½@4.35c., New York.

The London market has been quiet throughout the week, most of the business being done at a reduction of 1s. 3d. from the last price. The close is again somewhat firmer at £15 17s. 6d. for Spanish, and £16 for English lead.

Spelter—The market remains in its very peculiar condition. It seems to be almost entirely bare of supplies up to the end of this year, and any buyer who finds himself in the unfortunate position of providing spelter for these deliveries has to pay fancy prices. Such business, however, has been in relatively small quantities and is not representative of the broad market for supplies for consumption, which now centers upon January delivery. A fair business was done for January delivery at higher prices, and more interest was shown among consumers for later deliveries, which could be had at a discount. The market closes strong at 6.30@6.40c., St. Louis, and 6.45@6.55c., New York.

A much better demand is reported from Europe, where prices have also advanced about 10s. The London market is cabled as firm at £26 17s. 6d. for good ordinaries, and £27 2s. 6d. for specials.

Zinc dust is quoted at 7½c. per lb., New York.

Base price of zinc sheets has been advanced ¼c. per lb., and is now $8.25 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—Business has been on a fair scale and prices are a shade higher. We quote 18⅝@19c. for No. 1 ingots, New York.

Antimony—Business remains on a moderate scale. Cookson's can be had a little lower, at 7.87½@8c. per lb. Hallett's is still quoted at 7.50@7.75c.; while 6.75@7c. per lb. is named for Hungarian, Chinese and other outside brands.

Quicksilver—Business is steady and prices are unchanged. New York quotation is $45 per flask of 75 lb., with the usual advance for small quantities. San Francisco, $44.50 for domestic orders and $42 for export. London price is £8 10s. per flask, with £8 7s. 6d. quoted by second hands.

Nickel—Large lots, contract business, 40@50c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

It is announced that the voting-trust agreement proposed for the International Nickel Company has been ratified by the deposit of more than a majority of the stock. The agreement, which is dated Aug. 4, is to continue for five years from that date, and was framed for the purpose of insuring the continuance of the present management. The voting trustees are Edmond C. Converse, Joseph R. De LaMar, Ambrose Monell, Robert M. Thompson, and Ezra F. Wood.

Zinc and Lead Ore Markets

Platteville, Wis., Nov. 18—The highest price paid this week for zinc ore was $47; the base price, 60 per cent. zinc, was $45. The base offerings for lead ore were stronger at $53@54, but no shipments were reported.

SHIPMENTS, WEEK ENDED NOV. 18

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton	541,800	.....	170,000
Platteville	525,900	.....	.....
Mineral Point	468,860	.....	.....
Galena	318,220	.....	.....
Cuba City	288,930	.....	.....
Highland	174,450	.....	.....
Hazel Green	140,000	.....	.....
Harker	63,070	.....	.....
Total	2,521,230	.....	170,000
Year to date	135,191,849	7,980,835	25,754,970

Shipped during week to separating plants, 1,324,700 lb. zinc ore.

Joplin, Mo., Nov. 18—The high price of zinc sulphide ore was $50 per ton, the base, per ton of 60 per cent. zinc, was $44@48, with the contract base at $47.96. Zinc silicate ore sold on a base of $25@27 per ton of 40 per cent. zinc. The average, all grades of zinc, was $43.52. Lead sold as high as $60 per ton, with few sales as low as $57. The average price, all grades of lead, was $56.66 per ton.

The return of the St. Louis Smelting and Refining Company to this field, as a purchaser of lead ore, has strongly stimu-

ulated prices of this mineral. Producers of a considerable quantity of zinc ore withheld their ore from the market offerings until prices were advanced at the week-end to a base of $47@48 per ton. Recent purchases have taken up several of the larger accumulations of zinc ore, but in the removal of these older accumulations new reserves are being made at other points, the production keeping pace with the shipments.

SHIPMENTS, WEEK ENDED NOV. 18

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,449,750	.....	1,425,910	$141,469
Joplin	1,974,240	.....	288,520	53,770
Galena	862,370	.....	138,590	23,294
Duenweg	701,630	102,990	24,620	18,032
Alba-Neck	545,020	.....	53,810	14,367
Cave Springs	435,680	.....	6,010	10,618
Oronogo	469,810	.....	77,540	10,455
Carl Junction	424,960	.....	.....	10,410
Granby	10,600	639,190	21,180	8,880
Miami	237,710	.....	129,460	7,900
Jackson	126,680	.....	96,910	5,500
Spurgeon	131,500	86,740	29,100	5,080
Quapaw	190,090	.....	46,110	5,070
Lawton	122,600	.....	.....	2,696
Wentworth	62,540	.....	.....	1,365
Aurora	.....	66,000	.....	1,055
Saginaw	.....	31,170	15,000	910
Carthage	.....	18,120	.....	235
Totals	10,745,180	944,210	2,352,760	$321,106
46 weeks	442,886,150	32,695,510	79,882,950	$11,705,652

Blende val., the week, $241,691; 46 weeks, $8,936,554
Calamine, the week, 12,749; 46 weeks, 500,136
Lead value, the week, 66,666; 46 weeks, $2,268,962

MONTHLY AVERAGE PRICES

Month	Zinc Ore: Base Price		Zinc Ore: All Ores		Lead Ore: All Ores	
	1910	1911	1910	1911	1910	1911
January	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February	40.69	40.21	39.47	39.16	53.64	54.46
March	43.60	39.85	39.71	38.45	51.26	54.57
April	41.00	38.88	39.33	37.47	49.72	56.37
May	40.19	38.25	37.51	36.79	48.16	55.21
June	40.20	40.50	37.83	38.18	48.80	56.49
July	39.63	40.75	36.80	38.36	48.59	58.81
August	40.13	42.50	37.32	41.28	49.75	60.74
September	43.45	42.63	39.96	41.29	54.73	59.33
October	43.31	42.38	40.50	40.89	53.18	54.72
November	47.20	.....	43.20	.....	54.80	.....
December	42.50	.....	40.70	.....	55.70	.....
Year	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

CHEMICALS

New York, Nov. 22—Trade generally is improving and there are signs of more activity.

Copper Sulphate—Business is good and prices remain firm at last quotations, $4.50 per 100 lb. for carload lots, and $4.75 per 100 lb. for smaller orders.

Arsenic—There has been little buying, but holders are not pressing to sell, and quotations are unchanged at $2.25@2.37½ per 100 lb. for white arsenic.

Nitrate of Soda—Business is good in this article. Spot nitrate is still quoted at 2.22½c. per lb. Futures are a little firmer, 2.25c. being quoted for all positions next year.

MINING STOCKS

New York, Nov. 22—The general stock markets early in the week were more active and had an advancing tendency. Later, however, there were some recessions and a narrower business, and the close is irregular.

On the Curb there was a good deal of trading in copper stocks, and some advances. Business fell off later and the volume of business decreased. At the close prices were advanced on moderate sales. The market for Cobalt and Porcupine stocks was a little broader.

At auction in New York, Nov. 16, one $500 first-mortgage bond Nome Mining Trust brought $15; 100 shares American Coal Company of Maryland, $25 par, $80 per share; lot consisting of 2000 shares Barnes King Development Company, $5 each; 2070 shares Copper Securities, $25 each; 6500 shares Copper Securities, $5 each; 1480 shares Sinnemahoning Iron and Coal Company preferred, $50 each; 6711 shares Sinnemahoning Iron and Coal Company common, $50 each; 9000 shares Guerrero Mines Company, $5 each; $20,000 People's Gas Lght and Coke Company of Buffalo 5 per cent. bonds, $650 for the lot.

In New York, Nov. 20, the following securities hypothecated by the Newfoundland Syndicate, now bankrupt, were sold at auction, bringing $1000 for the lot: Preferred stock of the Pilleys Island Pyrites Company, par value $160,000, and $297,300 of the common stock; $200,000 preferred stock of the Terra Nova Company, and $299,500 of the common stock; $99,500 stock of the National Metallurgic Company; $479,500 stock of the Betts Cove Sulphur, Copper and Iron Company; $250,000 ten-year first-mortgage 6 per cent. sinking-fund gold bonds of the Pilleys Island Pyrites Company, and $150,000 ten-year first-mortgage 6 per cent. bonds of the Terra Nova Company.

Boston, Nov. 21—The market for mining shares shows a strong broadening tendency from day to day, with a higher range of prices right through the list.

North Butte acts queerly, and while the tape indicates that there is inside liquidation, brokers, as a rule, advise its purchase. The directors meet for dividend action next month. The stock, after breaking to $21, has recovered to above $24. Calumet & Arizona is the favorite and records a $5.25 advance to $56.50. The regular $1 quarterly dividend has been declared, payable Dec. 18.

Some of the Lake Superior issues have taken quite a move upward. Old Dominion moves quickly on light trading, having risen $3.12½ to $47.50.

Island Creek is also a favorite, with a $2 advance. The Pond Creek Coal Company adjacent to the Island Creek, and owned by about the same people, has been floated at $15 per share. The offering was 100,000 shares.

Curb trading has been more animated

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	August	Sept.	October
Alaska shipments	2,095,690	2,807,240	.....
Anaconda	22,500,000	21,565,800	21,400,000
Arizona, Ltd	2,720,000	2,544,000	2,720,000
Balakiala	.....	.....	.....
Copper Queen	7,006,097	6,546,540	7,786,218
Calumet & Ariz	4,650,000	4,198,000	4,784,000
Detroit	2,080,100	1,864,050	2,086,624
East Butte	854,000	1,134,000	920,000
Mammoth	.....	.....	.....
Nevada Con	5,249,515	5,328,983	5,547,931
Old Dominion	1,982,000	2,032,000	.....
Shannon	1,442,560	1,550,080	1,124,000
South Utah	269,546	266,000	.....
United Verde*	2,500,000	2,750,000	.....
Utah Copper Co	9,010,669	9,285,381	8,660,729
Lake Superior*	19,000,000	18,500,000	18,440,000
Non-rep. mines*	17,100,000	16,500,000	17,500,000
Total production	98,460,177	96,872,674	.....
Imports, bars, etc.	22,798,151	26,679,736	.....
Total blister	121,258,328	123,552,410	.....
Imp. in ore & matte	9,821,942	6,408,799	.....
Total	131,080,270	129,961,209	.....
Brit. Col. Cos.:			
British Col. Copper	736,515	875,023	.....
Granby	.....	.....	.....
Mexican Cos.:			
Boleo	2,149,028	2,094,400	1,245,440
Cananea	.....	.....	5,804,000
Moctezuma	2,263,707	2,112,683	1,719,643
Other Foreign:			
Cape Cop., S. Africa	.....	.....	.....
Spassky, Russia	649,600	759,360	.....
Exports from:			
Chile	4,032,000	4,816,000	4,816,00
Australia	7,392,000	6,496,000	7,056,00

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export
X, 1910	126,469,284	67,814,172	68,186,912
XI	119,353,463	60,801,992	67,424,316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,936,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349

VISIBLE STOCKS.

	United States.	Europe.	Total.
XI, 1910	139,261,914	198,060,800	337,322,711
XII	130,389,069	193,200,000	323,589,095
I, 1911	122,030,195	236,629,120	358,649,373
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

and at higher prices. Calaveras came back to $1 per share. A new Curb listing is the Southwestern Miami Development Company. There are 25,000 shares listed, $1 paid in. The initial transactions were around $2. Ahmeek rose to above $200 on the Curb.

Assessments

Company	Delinq	Sale	Amt
Andes, Nev	Nov. 2	Nov. 28	$0.05
Best & Belcher, Nev	Dec. 6	Dec. 29	0.05
Caledonia, Nev	Dec. 11	Jan. 2	0.10
Cedar Talisman, Utah	Nov. 9	Nov. 28	0.005
Challenge, Nev	Nov. 21	Dec. 12	0.05
Copper Mountain, Ida	Nov. 1	Dec. 1	0.002
Eureka-Swansea Ex., Utah	Dec. 14		0.01
Hider-Nevada, Nev	Nov. 4	Nov. 25	0.001½
Highland, Utah	Oct. 25	Nov. 25	0.01
Kinsley Development, Utah	Nov. 20	Dec. 11	0.C02
New York-Bonanza, Utah	Nov. 7	Nov. 28	0.02
Ojibway, Mich	Jan. 10		1.00
Opex, Utah	Dec. 13		0.01
Pioche Metals, Utah	Nov. 20	Dec. 11	0.005
Rainbow, Utah	Dec. 1	Dec. 20	0.002½
Raven, Mont	Feb. 1		0.10
San Antonia, Mex	Nov. 20		0.50
Savage, Nev	Nov. 23	Dec. 14	0.10
Seg. Belcher, Nev	Nov. 2	Nov. 27	0.05
Sierra Nevada, Nev	Oct. 28	Nov. 21	0.10
Superior & Boston, Ariz	Oct. 16		0.50
Swansea, Utah	Nov. 13		0.01
Torino, Ida	Oct. 27	Nov. 27	0.001
Union Con., Nev	Nov. 27	Dec. 19	0.15
Utah Con. M. & M., Utah	Dec. 20		0.002½
Utah Con. Tintic, Utah	Dec. 7		0.01
Victoria, Mich	Aug. 21		1.00
Winona, Mich	Nov. 10		1.00

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	52.745	23.227	23.690	24.324
April	51.428	53.221	53.325	23.708	24.483	24.595
May	52.905	53.870	53.308	24.343	24.797	24.583
June	52.538	53.462	53.043	24.166	24.651	24.486
July	51.043	54.150	52.630	23.519	25.034	24.286
August	51.125	52.912	52 171	23.588	24.428	24.082
September	51.440	53.295	52 440	23.743	24.567	24.209
October	50.923	55.490	53.340	23.502	25.596	24.594
November	50.703	55.635		23.351	25.680	
December	52.226	54.428		24.030	25.160	
Total	51.502	53.486		23.706	24.670	

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733	12.019	13.091	12.275	57.238	54.035
May	12.550	11.989	12.885	12.214	56.313	54.313
June	12.404	12.385	12.798	12.611	55.310	56.368
July	12.215	12.463	12.570	12.720	54.194	56.670
August	12.490	12 405	12.715	12.634	55.733	56.264
September	12.379	12 201	12 668	12.508	55.207	55 253
October	12.553	12.189	12 788	12.370	56.722	55.176
November	12.742		12 914		57 634	
December	12 581		12.863		56.769	
Year	12.738		13.039		57.054	

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1910.	1911.	Month	1910.	1911.
January	32.700	41.255	July	32.695	42.400
February	32 920	41 614	August	33.972	43 319
March	32.403	40.157	September	34.982	39 755
April	32.976	42 185	October	36.190	41.185
May	33.125	43.115	November	36 547	
June	32.769	44.606	December	38.199	
			Av. Year	34.123	

Prices are in cents per pound.

LEAD

Mohth	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376	4.412	4.225	4.262	12.641	12.889
May	4.315	4.373	4.164	4.223	12.550	12.984
June	4.343	4.435	4.207	4.292	12.688	13.260
July	4.404	4.499	4.291	4.397	12.531	13.530
August	4.400	4.500	4.290	4.406	12.513	14.026
September	4.400	4.485	4.289	4.356	12.582	14.744
October	4.400	4.265	4.271	4.139	13.091	15.332
November	4.442		4.314		13.217	
December	4.500		4.363		13.197	
Year	4.446		4.312		12.920	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439	5.399	5.289	5.249	22.469	23.743
May	5.191	5.348	5.041	5.198	22.100	24.375
June	5.128	5.520	4.978	5.370	22.094	24.612
July	5.152	5.695	5.002	5.545	22.406	25.006
August	5.279	5 953	5.129	5 803	22.800	26 801
September	5.514	5 869	5.364	5 719	23.165	27 750
October	5.628	6.102	5.478	5.951	23.900	27.256
November	5.976		5.826		24.083	
December	5.624		5.474		24.019	
Year	5.520		5.370		23 050	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1910	1911	1910	1911	1910	1911
January	$19.90	$15.90	$17.96	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28	15.90	16.84	14.65	16.75	15.00
May	17.10	15.90	15.94	14.30	16.18	14.72
June	16.52	15.90	15.60	14.06	15.53	14.56
July	16.40	15.90	15.40	14.03	15.40	14.53
August	16.09	15.90	14.89	14.00	15.16	14.47
September	15.92	15.90	14.73	13.57	14.93	14.40
October	15.90	15.43	14.05	13.44	14.88	14.34
November	15.84		14.26		14.78	
December	15.90		14.15		14.65	
Year	$17.10		$15.65		$15.83	

STOCK QUOTATIONS

COLO. SPRINGS Nov. 21

Name of Comp.	Bid.
Acacia	.04¾
Cripple Cr'k Con.	.03
C. K. & N.	.13½
Doctor Jack Pot.	.08
Elkton Con.	.74
El Paso	.75½
Findlay	.07
Gold Dollar	.17½
Gold Sovereign	.02½
Isabella	.14½
Jack Pot	.07½
Jennie Sample	.08
Lexington	.02½
Moon Anchor	.02½
Old Gold	.04½
Mary McKinney	.52½
Pharmacist	.02½
Portland	.98
Vindicator	.74½
Work	.02½

SALT LAKE Nov. 21

Name of Comp.	Bid.
Beck Tunnel	.17½
Black Jack	.09½
Carisa	‡.16
Cedar Talisman	.03½
Colorado Mining	.28½
Columbus Con	‡.28½
Daly Judge	‡4.12½
Grand Central	.86
Iron Blossom	1.02½
Little Bell	.37
Lower Mammoth	.02½
Mason Valley	8.50
May Day	.11½
Nevada Hills	2.62½
New York	‡.05½
Prince Con	.85
Silver King Coal'n	1.60
Sioux Con	.12½
Uncle Sam	.24
Yankee	‡.13

TORONTO Nov. 21

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.25	Pearl Lake	.46½
Hudson Bay	80.00	Porcu. Gold	.56½
Temiskaming	.32½	Porcu. Tisdale	.05
Wettlaufer-Lor	.82	Preston E. D.	.21½
Apex	.11	West Dome	.98
Central	3.90	Standard	.15½
Dobie	1.03	Foley O'Brien	.70
Dome Exten	.75	Rea	2.99
Hollinger	10.80	Coronation	‡.03
Imperial	.09¾	Swastika	.31½

SAN FRANCISCO Nov. 21

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.03	Belmont	8.10
Belcher	.65	Jim Butler	.23
Best & Belcher	.13	MacNamara	.26
Caledonia	.88	Midway	.24
Challenge Con	.20	Mont.-Tonopah	.94
Chollar	.11	North Star	.35
Confidence	.54	West End Con	.76
Con. Virginia	.65	Atlanta	.18
Crown Point	.85	Booth	.07
Gould & Curry	.08	C.O.D. Con	.16
Hale & Norcross	.16	Comb. Frac	.11
Mexican	3.55	Jumbo Extension	.21
Occidental	.50	Pitts.-Silver Peak	1.20
Ophir	1.52½	Silver Pick	.07
Overman	.80	St. Ives	.35
Potosi	.16	Tramps Con	.03
Savage	.26	Argonaut	‡2.50
Sierra Nevada	.41	Bunker Hill	‡6.50
Union Con	1.40	Cent. Eureka	.42
Yellow Jacket	.74	So. Eureka	‡6.00

N. Y. EXCH. Nov. 21

Name of Comp.	Clg.
Amalgamated	64
Am. Agri. Chem	54⅛
Am.Sm.&Ref.,com	74
Am. Sm.& Ref., pf.	102¼
Anaconda	38⅜
Batopilas Min	1¾
BethlehemSteel pf	58¾
Chino	23⅝
Comstock Tunnel	‡.19
Federal M.& S., pf.	48
Goldfield Con	4½
Great Nor., ore ctf.	43
Homestake	85
Miami Copper	22
Nat'nalLead,com.	51¾
National Lead, pf.	104¾
Nev. Consol	18¼
Pittsburg Coal, pf.	84½
Ray Con	15½
RepublicI&S,com	23¼
Republic I & S, pf.	83
SlossSheffi'd,com.	40½
Sloss Sheffield, pf.	110
Tennessee Copper	37⅜
Utah Copper	50½
U. S. Steel, com.	63¾
U. S. Steel, pf.	109½
Va. Car. Chem	53½

N. Y. CURB Nov. 21

Name of Comp.	Clg.
Barnes King	.25
Beaver Con	.44
Braden Copper	5⅜
B. C. Copper	3⅞
Buffalo Mines	1.50
Butte & Vipond	.54
Butte Coalition	18
Cobalt Central	.01
Con. Ariz Sm	5/8
Davis-Daly	1 1/16
Ely Con	5/16
Florence	.78
Giroux	4 3/16
Gold Hill Con	1/16
Greene Cananea	8
Greenwater	.05
Guanajuato	‡33/4
Guerrero	‡1¼
Guggen. Exp	170
Inspiration	83¾
Internat. S. & R.	‡124
Kerr Lake	3⅜
La Rose	3 1/16
McKinley-Dar-Sa.	1 1/16
Min. Co. of A. new	4
Nev. Utah M. & S.	1/16
Nipissing Mines	7⅜
Ohio Copper	1⅛
Pacific Sm. & M.	3/8
Precious Metals	‡1 3/16
Ray Central	1 1/16
Red Warrior	‡1 3/16
South Utah M.& S.	1/16
Standard Oil (Old)	625
Stand'd Oil of N.J.	340
Stand'd Oil Subs.	325
Stewart	.79
Tonopah	7
Tonopah Ex	1⅜
Tri-Bullion	3/16
Tularosa	‡3/16
Union Mines	‡1/16
Yukon Gold	3 3/16

LONDON Nov. 22

Name of Com.	Clg.
Camp Bird	£1 10s 6d
Dolores	1 10 0
El Oro	1 2 6
Esperanza	1 11 10½
Mexico Mines	7 7 6
Oroville	0 5 6
Stratton'sInd.	0 2 0
Tomboy	1 2 6

BOSTON EXCH. Nov. 21

Name of Comp.	Clg.
Adventure	5
Algomah	3¾
Allouez	36½
Am. Zinc	24¾
Arcadian	2
Arizona Com	.26
Atlantic	‡6
Bonanza	.35
Boston & Corbin	5⅜
Butte & Balak	4
Calumet & Ariz	55⅞
Calumet & Hecla	405
Centennial	12
Con. Mercur	.03
Copper Range	57
Daly-West	5¼
East Butte	11¾
Franklin	8¼
Granby	33
Hancock	21¾
Hedley Gold	14¼
Helvetia	1
Indiana	10¾
Isle Royale	18
Keweenaw	.80
Lake	34
La Salle	5½
Live Oak	28¼
Mass	7⅞
Michigan	1⅛
Mohawk	45
New Arcadian	2
North Butte	24
North Lake	5¾
Ojibway	4½
Old Dominion	47
Osceola	95
Parrot	10
Quincy	62¾
Shannon	8¾
Shattuck-Ariz	15¾
Superior	26¾
Superior & Bost.	3¾
Tamarack	27
Trinity	4¾
Tuolumne	3⅞
U. S. Smelting	34⅝
U. S. Smelt'g, pf.	47
Utah Apex	2⅝
Utah Con	15¾
Victoria	2¼
Winona	5¾
Wolverine	90
Wyandot	.80

BOSTON CURB Nov. 21

Name of Comp.	Last
Ahmeek	197
Bingham Mines	1½
Boston Ely	.95
Boswyocolo	.11
Cactus	.25
Calaveras	1
United Verde Ext.	1
Chief Cons	.67
Corbin	.93
Cortez	1¼
Crown Reserve	2⅞
First Nat. Cop	1⅞
Majestic	.38
Mazatan	.35
Moneta Porc	.10
Nat'l Mine & Ex.	.09
Nevada-Douglas	2⅞
New Baltic	3⅞
Oneco	1½
Raven Copper	.26
Rhode Island Coal	1¼
San Antonio	‡3½
South Lake	4½
Trethewey	.60
United Zinc, pfd.	‡2
Vulture	‡5
Yuma	‡.02

‡Last quotation.